SOIL SURVEY OF

Boone, Campbell, and Kenton Counties, Kentucky

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Kentucky Agricultural Experiment Station

Issued August 1973

Major fieldwork for this soil survey was done in the period 1965–67. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Soil and Water Conservation Districts of Boone, Campbell, and Kenton Counties.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Boone, Campbell, and Kenton Counties are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise; it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the counties in alphabetic order by map symbol and gives the capability classification and woodland suitability grouping of each. It also shows the page where each soil is described and the page for the capability unit and the woodland suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the section "Use of the Soils for Crops and Pasture."

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Town and Country Planning."

Engineers and builders will find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in the area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the Area," which gives additional information about the survey area.

Cover: Church on Rossmoyne silt loam, one-fourth mile west of Florence. This soil has moderate limitation as a building site because it has a seasonal high water table (water at a depth of 1 to 2 feet, perched over a fragipan) and a moderate shrink-swell potential.

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SOIL SURVEY OF BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

BOONE, CAMPBELL, AND KENTON COUNTIES are the three northernmost counties in Kentucky (fig. 1). The three counties are 25 to 30 miles wide from east to west and 20 to 22 miles long from north to south. The total land area is 360,320 acres, or about 563 square miles. In 1960 the total population was about one quarter million, but the urban area is a part of the Greater Cincinnati Metropolitan Area, which has a population of more than a million.

The counties, part of the Kentucky Bluegrass Region, are bounded by the Ohio River on the north. The Licking River separates Campbell and Kenton Counties. Most of the soils formed in material weathered from limestone or calcareous shale, but many soils in the northern part of the survey area formed in glacial deposits.

In recent years farming has declined. Many farmers are now working part time on the farm and full time on jobs in nearby cities or industrial areas.

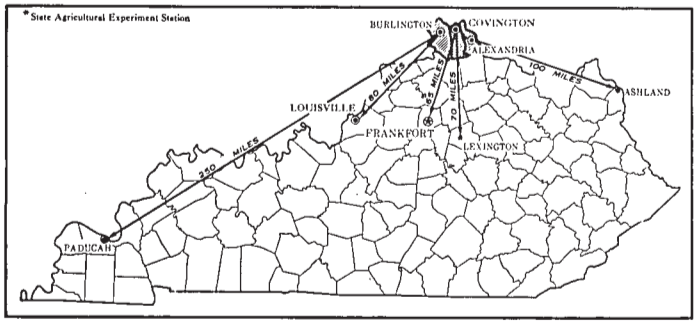

Figure 1.—Location of Boone, Campbell, and Kenton Counties in Kentucky.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Boone, Campbell, and Kenton Counties, where they are located, and how they can be used. The soil scientists went into the counties knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey (*15*).[1]

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Nicholson and Woolper, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Brashear silty clay loam, 6 to 12 percent slopes, is one of several phases within the Brashear series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show roads, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in

[1] Italic numbers in parentheses refer to Literature Cited, p. 65.

planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in this survey area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland, community planners, and engineers.

On the basis of data collected and tested for key soils in an area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Boone, Campbell, and Kenton Counties. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Boone, Campbell, and Kenton Counties are discussed in the following pages.

1. *Eden-Cynthiana association*

Dominantly steep to very steep soils that have a clayey subsoil; on limestone and shale uplands

This association occupies steep, highly dissected, hilly areas in the southern part of Boone, Campbell, and Kenton Counties and very steep hillsides bordering the Ohio and Licking Rivers (fig 2.). Slope ranges from 12 to 30 percent in most of the association, but is even steeper in areas bordering the rivers.

This association covers about 31 percent of Boone County, 61 percent of Campbell County, and 42 percent of Kenton County, or about 42 percent of the entire survey area. Eden soils make up about 80 percent of the association, Cynthiana soils 10 percent, and the minor soils 10 percent.

Eden soils are dominant throughout the association. Cynthiana soils are mostly in the northern part of Boone and Kenton Counties and are above the Eden soils. Minor soils in the association are the Faywood soils on ridgetops; the Brashear and Woolper soils on toe slopes; and the Boonesboro, Nolin, Chagrin, and Egam soils along small streams. Areas of Gullied land and Urban land are also in this association.

Eden soils are well drained and deep but somewhat droughty. They have a silty clay loam surface layer over a dark yellowish-brown silty clay subsoil that has slow permeability. Cynthiana soils are somewhat excessively drained and are shallow to limestone. They have a flaggy silty clay loam surface layer and dark yellowish-brown flaggy silty clay subsoil that has moderately slow permeability.

About half of this association is used for pasture; the other half is wooded or brushy. Slopes are generally too steep to be used for row crops. Little of the association is plowed, except for a small acreage planted to tobacco. The dominant soils are droughty. They are suited to grass, and alfalfa is easily established. The slopes, however, are difficult to mow because of flagstones, brush, and steepness.

2. *Faywood-Nicholson association*

Dominantly gently sloping to moderately steep soils that have a loamy to clayey subsoil; on ridgetops and side slopes of the limestone and shale uplands

This association is mostly in large rolling areas in central Kenton County and southeastern Boone County (fig. 3). Also, a few small areas are on the ridgetops around Cold Spring, Persimmon Grove, and other areas in Campbell County. Slope generally ranges from 2 to 20 percent.

This association covers about 22 percent of Boone County, 18 percent of Campbell County, and 44 percent of Kenton County, or about 27 percent of the survey area. Faywood soils make up about 60 percent of the association; Nicholson soils, 36 percent; and minor soils, 4 percent.

The Faywood soils occur on the narrow ridges and moderately steep side slopes bordering the Nicholson

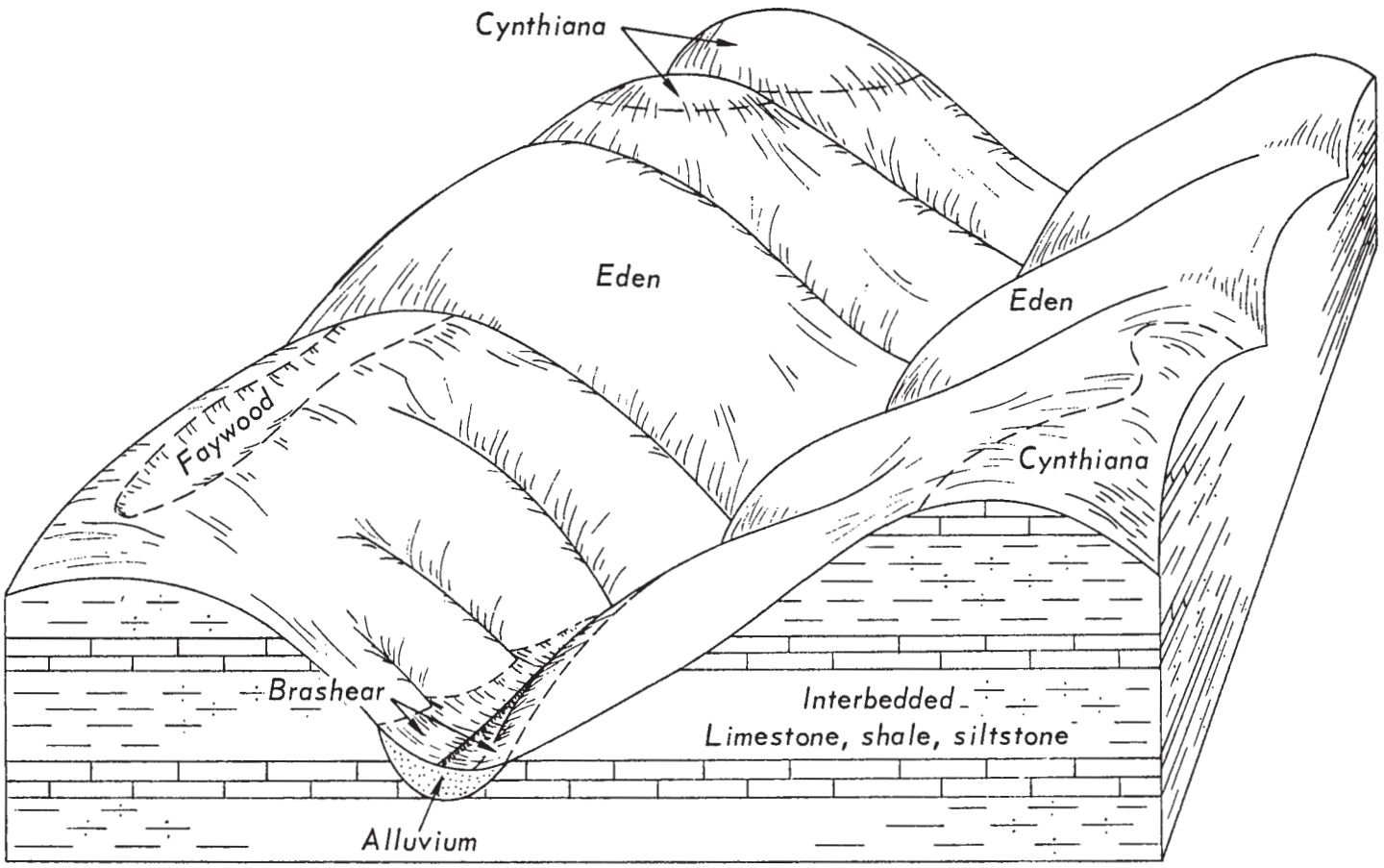

Figure 2.—**Relationship of soils in the Eden-Cynthiana association to topography and underlying material.**

soils. The Nicholson soils are gently sloping to sloping on ridgetops. Minor soils are Nolin, Lindside, and Newark soils along small streams. Areas of Urban land and Gullied land are also in this association.

Faywood soils are well drained and moderately deep to rock. They have a light silty clay loam or silt loam surface layer over a dominantly yellowish-brown silty clay loam to clay subsoil that has moderately slow permeability. Nicholson soils are well drained to moderately well drained and are deep to rock. They have a silt loam surface layer over a dominantly yellowish-brown, silty clay loam subsoil and are moderately deep to a slowly permeable fragipan.

A large part of the northern part of this association has been converted to urban use. The built-up areas are dominantly on the ridgetops and on the more gentle side slopes. Although much of the topography is suitable for buildings, shrinking and swelling of the clays in the lower layers of the soils are limitations for building foundations. Many wet spots occur as a result of a seasonal high water table and slow permeability in the subsoil.

The southern part of this association is used mostly for farming. Hay and pasture are the main uses. The main cash crop is tobacco, but only a small acreage is grown.

3. *Rossmoyne-Jessup association*

Nearly level to moderately steep soils that have a loamy to clayey subsoil; on ridgetops and side slopes of the glaciated uplands

This association (fig. 4) occupies broad, nearly level to sloping ridges and moderately steep side slopes in a glaciated area in the northern part of Boone County and the northwestern part of Kenton County. A few small areas are on hilltops in Campbell County near the Ohio River.

The association covers about 40 percent of Boone County, 4 percent of Campbell County, and 8 percent of Kenton County, or about 21 percent of the survey area. The Rossmoyne soils make up about 57 percent of the association; Jessup soils, about 33 percent; and minor soils, 10 percent.

The Rossmoyne soils are nearly level to sloping; they occupy the major part of the ridgetops. Jessup soils are mostly moderately steep and are on the side slopes. The minor Avonburg soils are nearly level. Most areas are near Burlington. Other minor soils are Nolin and Lindside soils on the flood plains and Negley soils on the uplands. Small areas of Urban land and Gullied land are in this association.

Rossmoyne soils are moderately well drained and are

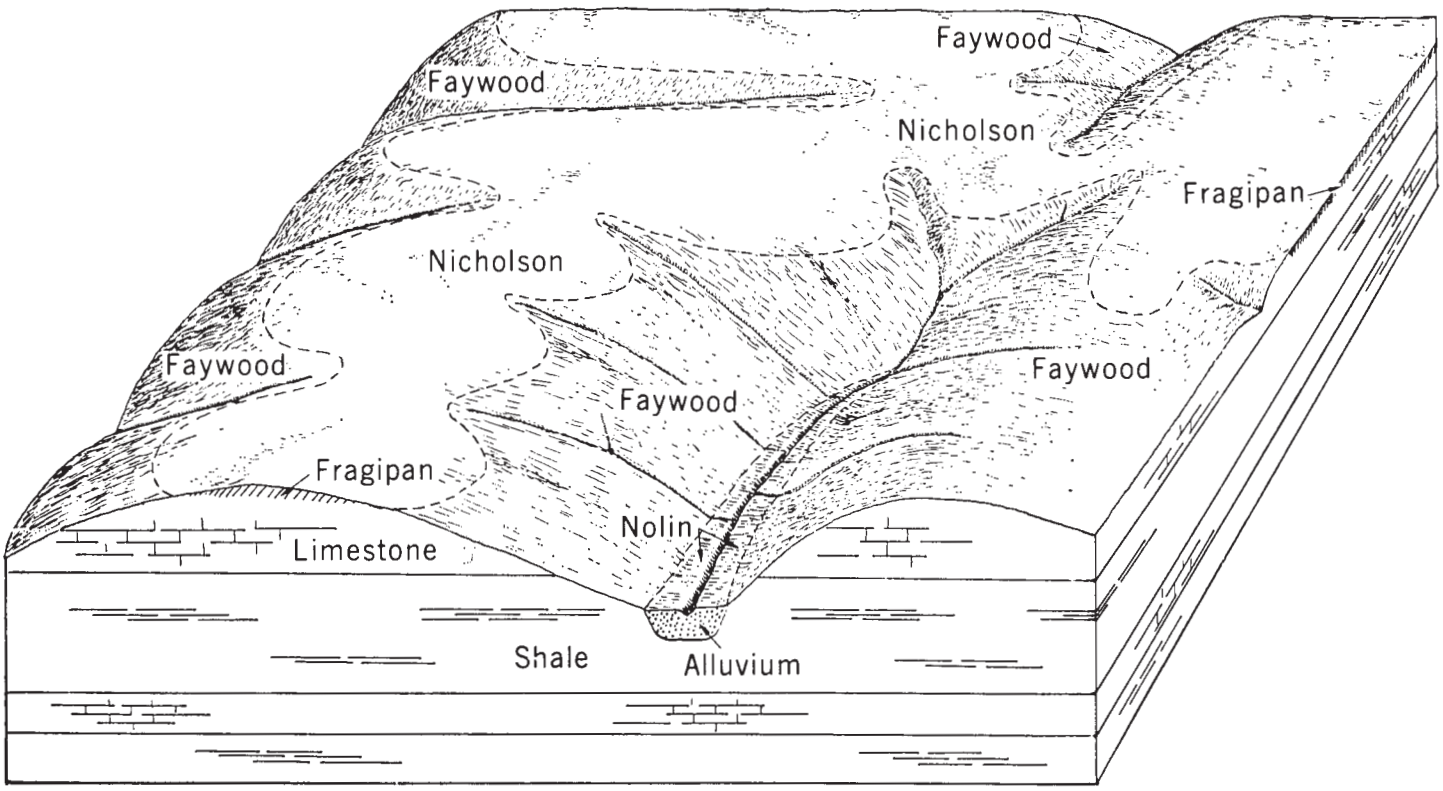

Figure 3.—**Relationship of soils in the Faywood-Nicholson association to topography and underlying material.**

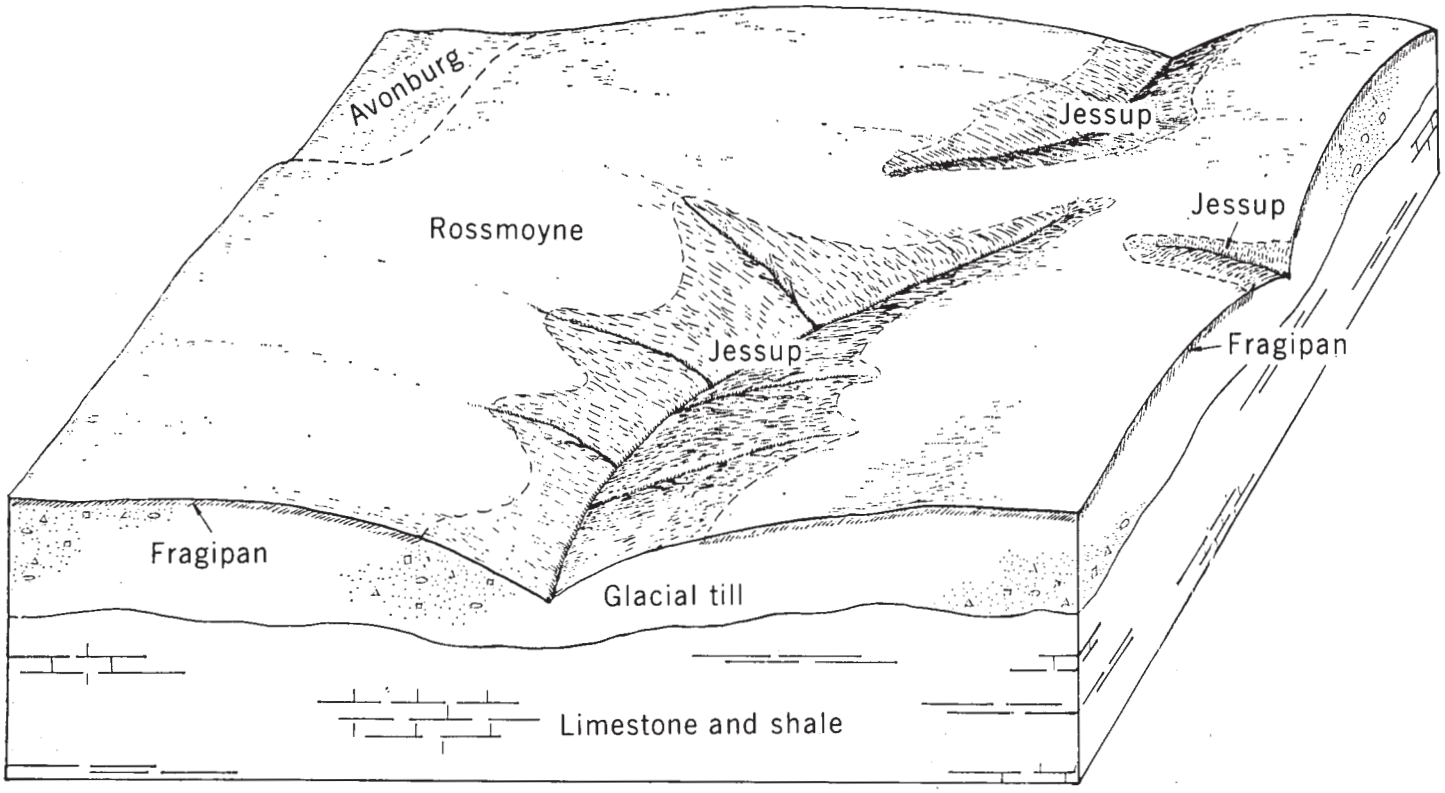

Figure 4.—**Relationship of soils in the Rossmoyne-Jessup association to topography and underlying material.**

deep to rock. They have a silt loam surface layer over a dominantly yellowish-brown silty clay loam subsoil that is mottled in the lower part. They are moderately deep to a slowly permeable fragipan about 2 feet thick.

Jessup soils are well drained and deep. They have a silt loam surface layer and a dominantly yellowish-brown subsoil. The subsoil is silty clay loam in the upper part and silty clay in the lower part. Permeability is slow in the lower part. The Rossmoyne and Jessup soils are underlain by clayey glacial till.

Much of this association in Kenton County and in the northern part of Boone County has been converted to urban use. Many of the unimproved areas are potential sites for housing developments. The gently sloping areas are used for industrial development, but slope is a limitation on the side slopes. There are problems with building foundations because of the shrinking and swelling of the clays in the lower layers of the soils. Many wet spots occur as a result of a seasonal water table and the slowly permeable subsoil.

The western and southern part of this association in Boone County and some areas in Campbell County are used for farming. The main cash crop is tobacco, but a much larger acreage is used for hay and pasture. Only a few areas are used for corn and other row crops. The soils are suited to most crops if properly managed.

4. Licking-Captina association

Dominantly gently sloping to moderately steep soils that have a clayey to loamy subsoil; on stream terraces

This association is on stream terraces and in bottoms along the Licking River. It also includes a large area in the central part of Campbell County that appears to be an old lakebed, because the area is surrounded by hills that are higher in elevation (fig. 5).

Slopes are commonly gently sloping to sloping. In some areas of this association, the soils are nearly level. In other places slopes are moderately steep. This association makes up about 11 percent of Campbell County and 4 percent of Kenton County, or about 5 percent of the survey area. Licking soils make up 46 percent of the association; Captina soils, 18 percent; and minor soils, 36 percent.

Licking soils are dominantly gently sloping to moderately steep in the more dissected areas and are dominantly gently sloping in the less dissected areas. Minor soils are the somewhat poorly drained Lawrence soils and the poorly drained Robertsville soils on stream terraces and the Newark, Nolin, Chagrin, Lindside, and Boonesboro soils on flood plains. Also, there are areas of Alluvial land, steep, in this association.

The Licking soils are moderately well drained and deep. They have a surface layer that ranges in texture from silt

Figure 5.—Undulating to gently rolling soils of the Licking series in the foreground and soils of the Eden series in the hilly background.

loam to silty clay. The subsoil is silty clay loam in the upper part but clayey in the lower part; it is yellowish brown throughout. Permeability is moderately slow. Captina soils are moderately well drained and deep to rock; they have a silt loam surface layer. The subsoil is yellowish brown in the upper part and mottled gray and brown in the lower part. Texture of the subsoil is silty clay loam. Captina soils are moderately deep to a slowly permeable fragipan.

The northern part of this association is used mostly for industry, residences, and other nonfarm purposes. Slow permeability and high shrink-swell potential are the main limitations for use of the major soils in the association. Some of the minor soils are subject to flooding.

The southern part of the association is used mostly for farming. Much of the land is in pasture or hay, and some areas are used for production of corn and tobacco. The association soils are suited to most types of farming.

5. *Wheeling-Huntington-Alluvial land, steep association*

Dominantly nearly level and gently sloping soils that have a loamy subsoil; on stream terraces, first bottoms, and moderately steep to steep areas of variable textured alluvium

This association consists of soils on stream terraces and bottoms along the Ohio River and a few of its small tributaries.

It covers about 7 percent of Boone County, 6 percent of Campbell County, and 2 percent of Kenton County. This association is about 5 percent of the entire survey area. Wheeling soils make up about 18 percent of this association; Huntington soils, about 17 percent; and Alluvial land, steep, about 15 percent. Many minor soils make up about 50 percent.

The Wheeling soils are on the stream terraces. They are dominantly gently sloping. Huntington soils are nearly level soils on the first bottoms. Alluvial land is on steep areas along the riverbank and between the terraces and bottoms. Minor soils are Lakin, Chavies, Ashton, and Avonburg on the terraces and Egam, Nolin, Lindside, and Newark soils on the bottoms. Areas of Urban land occur in the larger cities or towns.

The Wheeling soils on the stream terraces are well drained and deep. They are dark grayish brown to dark brown and are loamy in the surface layer and subsoil. They are moderately permeable. The Huntington soils on the flood plains are similar to the Wheeling soils in both drainage and depth, but they are darker colored and less acid. The texture of Huntington soils is silt loam throughout, and they are moderately permeable. Alluvial land, steep, is variable in profile characteristics. The texture ranges from sandy loam to silty clay. Some profiles are mottled; others have a uniform color.

Twelve small towns and five large towns or cities are in this association. These include Ludlow, Covington, Newport, Bellevue, and Dayton. Where flooding is not a hazard, the soils of this association are generally well suited to nonfarm uses.

Some areas in the association are used for gardens, commercial vegetables, and corn. Other areas are used for fruit trees and ornamental trees or flowers. These soils are well suited to both farming and horticulture uses.

Gravel and sand are quarried in several places in this association near the Ohio River.

Descriptions of the Soils

In this section the soils of Boone, Campbell, and Kenton Counties are described in detail. The soils of each series are first described as a group. Important features common to all the soils of the series are listed, and the position of the soils on the landscape is given. Each series description contains a short narrative description of a representative profile. A much more detailed technical description of the same profile is also included. Following the profile description is a brief statement of the range of characteristics of the soils in the series. Comparisons are made with other soils that are located nearby or that are generally similar to the soils of the series being described.

Each single soil, or mapping unit, in the series is next described. Single soils are the areas delineated on the map and identified by soil symbols. Generally these descriptions tell how the profile of the soil differs from that described as representative of the series. They also tell about the use and suitability of the soil described and something about management needs.

Table 1 gives the approximate acreage and proportionate extent of the soils in the survey area.

For full information about any one mapping unit, it is necessary to read the description of the soil series and the description of the mapping unit. General information about the broad patterns of soils in the counties is given in the section "General Soil Map." The color names and color symbols given are for moist soil unless otherwise indicated.

Alluvial Land, Steep

Alluvial land, steep (AID) consists of rather narrow, steep areas along the riverbanks, on the edges of stream terraces, and on the edges of glaciated soils. Because soil material is stratified in these areas, no one profile is typical. Soil texture ranges from sandy loam to silty clay. In some places the soil is mottled, but in other places there is no mottling.

Most of this land is in scrub brush, weeds, and trees. Erosion is a hazard because surface runoff is rapid. Flooding is a limitation for most uses along the riverbanks. (Not in a capability unit; woodland suitability group 8)

Ashton Series

The Ashton series consists of deep, well-drained soils that have a loamy subsoil. These soils formed in alluvium, chiefly of limestone origin. They are on low stream terraces in small scattered areas, mostly along the Licking and Ohio Rivers. Slope ranges from 0 to 6 percent.

In a representative profile the plow layer is dark-brown silt loam 10 inches thick. The subsoil is friable, slightly acid, dark yellowish-brown silt loam and light silty clay loam about 20 inches thick. The substratum extends to a depth of more than 50 inches. It is yellowish-brown, friable silt loam that has faint mottles.

TABLE 1.—*Approximate acreage and proportionate extent of the soils by county and in survey area*

Soil	Boone County		Campbell County		Kenton County		Total	
	Acres	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*
Alluvial land, steep	2, 230	1. 4	1, 850	1. 9	1, 000	1. 0	5, 080	1. 4
Ashton silt loam, 0 to 2 percent slopes	440	. 3	10	(1)	10	(1)	460	. 1
Ashton silt loam, 2 to 6 percent slopes	600	. 4	130	. 1	110	. 1	840	. 2
Avonburg silt loam	2, 010	1. 3	250	. 3	70	. 1	2, 330	. 6
Boonesboro silt loam	1, 030	. 6	140	. 1	490	. 5	1, 660	. 5
Brashear silty clay loam, 6 to 12 percent slopes	250	. 2	230	. 2	130	. 1	610	. 2
Brashear silty clay loam, 12 to 20 percent slopes	400	. 3	1, 080	1. 1	250	. 3	1, 730	. 5
Brashear silty clay, 12 to 20 percent slopes, severely eroded	20	(1)	930	1. 0	20	(1)	970	. 3
Captina silt loam, 2 to 6 percent slopes	100	. 1	1, 710	1. 8	870	. 8	2, 680	. 7
Captina silt loam, 6 to 12 percent slopes	10	(1)	430	. 4	200	. 2	640	. 2
Chagrin gravelly silty clay loam	120	. 1	330	. 3	320	. 3	770	. 2
Chavies fine sandy loam, 0 to 6 percent slopes	980	. 6	10	(1)	0	0	990	. 3
Chavies fine sandy loam, 6 to 12 percent slopes	290	. 2	20	(1)	0	0	310	. 1
Cynthiana flaggy silty clay loam, 12 to 20 percent slopes	280	. 2	0	0	10	(1)	290	. 1
Cynthiana flaggy silty clay loam, 20 to 50 percent slopes	13, 980	8. 6	250	. 3	800	. 8	15, 030	4. 2
Eden silty clay loam, 12 to 20 percent slopes, eroded	1, 810	1. 1	10, 920	11. 5	2, 920	2. 8	15, 650	4. 3
Eden silty clay loam, 20 to 35 percent slopes, eroded	28, 580	17. 9	42, 830	45. 0	35, 650	33. 8	107, 060	29. 7
Egam silty clay loam	750	. 5	510	. 5	590	. 6	1, 850	. 5
Faywood silt loam, 2 to 6 percent slopes	150	. 1	140	. 1	120	. 1	410	. 1
Faywood silty clay loam, 6 to 12 percent slopes	2, 410	1. 5	4, 640	4. 9	2, 100	2. 0	9, 150	2. 5
Faywood silty clay loam, 12 to 20 percent slopes	6, 450	4. 0	3, 000	3. 2	7, 820	7. 4	17, 270	4. 8
Faywood silty clay, 12 to 20 percent slopes, severely eroded	13, 120	8. 3	1, 980	2. 1	17, 500	16. 5	32, 600	9. 0
Gullied land	60	(1)	230	. 2	90	. 1	380	. 1
Huntington fine sandy loam	240	. 1	0	0	0	0	240	. 1
Huntington silt loam	1, 720	1. 1	650	. 7	160	. 2	2, 530	. 7
Jessup silt loam, 2 to 6 percent slopes	170	. 1	100	. 1	50	. 1	320	. 1
Jessup silt loam, 6 to 12 percent slopes	1, 710	1. 1	120	. 1	10	(1)	1, 840	. 5
Jessup silt loam, 12 to 20 percent slopes	17, 330	10. 9	630	. 6	1, 210	1. 2	19, 170	5. 3
Jessup silt loam, 20 to 30 percent slopes	830	. 5	0	0	10	(1)	840	. 2
Jessup silty clay loam, 12 to 20 percent slopes, severely eroded	3, 030	1. 9	220	. 2	190	. 1	3, 440	1. 0
Lakin loamy fine sand, 0 to 2 percent slopes	100	. 1	190	. 2	0	0	290	. 1
Lakin loamy fine sand, 2 to 12 percent slopes	870	. 5	180	. 2	30	(1)	1, 080	. 3
Lawrence silt loam	10	(1)	380	. 4	500	. 5	890	. 2
Licking silt loam, 0 to 2 percent slopes	10	(1)	340	. 4	180	. 2	530	. 1
Licking silt loam, 2 to 6 percent slopes	160	. 1	660	. 7	450	. 4	1, 270	. 4
Licking silty clay loam, 6 to 12 percent slopes	80	. 1	2, 130	2. 2	180	. 2	2, 390	. 7
Licking silty clay loam, 12 to 20 percent slopes	100	. 1	1, 920	2. 0	600	. 6	2, 620	. 7
Licking silty clay, 12 to 20 percent slopes, severely eroded	570	. 4	1, 280	1. 3	40	(1)	1, 890	. 5
Lindside silt loam	1, 440	. 9	700	. 7	260	. 2	2, 400	. 7
Negley silt loam, 2 to 6 percent slopes	20	(1)	560	. 6	40	(1)	620	. 2
Negley silt loam, 6 to 12 percent slopes	0	0	580	. 6	230	. 2	810	. 2
Negley silt loam, 12 to 20 percent slopes	20	(1)	160	. 2	560	. 5	740	. 2
Newark silt loam	850	. 5	1, 140	1. 2	530	. 5	2, 520	. 7
Nicholson silt loam, 0 to 6 percent slopes	7, 360	4. 6	3, 060	3. 2	9, 110	8. 7	19, 530	5. 4
Nicholson silt loam, 6 to 12 percent slopes	5, 190	3. 3	2, 520	2. 7	9, 090	8. 6	16, 800	4. 7
Nolin silt loam	1, 740	1. 1	1, 870	2. 0	1, 940	1. 8	5, 550	1. 5
Robertsville silt loam	50	(1)	190	. 2	560	. 5	800	. 2
Rossmoyne silt loam, 0 to 6 percent slopes	20, 710	13. 0	820	. 9	3, 000	2. 8	24, 530	6. 8
Rossmoyne silt loam, 6 to 12 percent slopes	16, 190	10. 1	680	. 7	2, 850	2. 7	19, 720	5. 5
Urban land	150	. 1	1, 840	1. 9	2, 620	2. 4	4, 610	1. 3
Wheeling silt loam, 0 to 2 percent slopes	550	. 3	60	. 1	0	0	610	. 2
Wheeling silt loam, 2 to 6 percent slopes	1, 400	. 9	460	. 5	0	0	1, 860	. 5
Wheeling silt loam, 6 to 12 percent slopes	410	. 3	150	. 2	10	(1)	570	. 2
Woolper silty clay loam, 6 to 12 percent slopes	80	. 1	50	. 1	70	. 1	200	. 1
Woolper silty clay loam, 12 to 20 percent slopes	200	. 1	100	. 1	50	(1)	350	. 1
Total	159, 360	100. 0	95, 360	100. 0	105, 600	100. 0	360, 320	100. 0

[1] Less than 0.05 percent.

The rooting zone is deep, and permeability is moderate. The surface layer is slightly acid to neutral, and natural fertility is high. Available moisture capacity is high, and organic-matter content is medium. These soils are easy to till, and they can be worked throughout a wide range of moisture content without forming clods. Flooding is a limitation for some uses.

Representative profile of Ashton silt loam, 0 to 2 percent slopes:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) when dry; weak, medium, granular structure; friable; neutral; clear, smooth boundary.

B1—10 to 18 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

B2t—18 to 30 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; few, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate to weak, fine and medium, subangular blocky structure; friable; few clay films; slightly acid; gradual, wavy boundary.

C—30 to 50 inches +, yellowish-brown (10YR 5/4) silt loam; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles and few, fine, faint, pale-brown (10YR 6/3) mottles; massive; friable; few black patches from decayed roots; slightly acid.

The solum ranges from 30 to 40 inches in thickness, and the depth to rock is more than 10 feet in most places. The B horizon is dark brown (7.5YR 4/3 or 7.5YR 4/4) and yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4). Texture of the C horizon ranges from silt loam to fine sand.

In the survey area these soils have a thinner solum than is defined as the range for the Ashton series, but they do not differ in use or behavior from Ashton soils in other places.

The Ashton soils occur with Chavies, Wheeling, Nolin, and Huntington soils. They have a darker colored Ap horizon and are less acid throughout the B horizon than Chavies and Wheeling soils. Also, Ashton soils are less sandy throughout the solum than Chavies soils. They show more evidence of clay accumulation, such as clay films, in the B horizon than Nolin and Huntington soils. The Ap horizon is also darker colored than that of Nolin soils.

Ashton silt loam, 0 to 2 percent slopes (AsA).—This soil is on low stream terraces or second bottoms. Areas range from 2 to 50 acres in size. The soil has the profile described as representative for the series.

A few small areas that have a dark grayish-brown plow layer were included in mapping.

There is little or no hazard of erosion. This soil is suited to all plants commonly grown in this area. It is well suited to cultivated crops, and a moderate acreage is used for tobacco and corn. (Capability unit I-2; woodland suitability group 1)

Ashton silt loam, 2 to 6 percent slopes (AsB).—This soil is on low stream terraces and foot slopes adjacent to uplands. Areas range from 2 to 10 acres in size.

Included in mapping were a few areas that have a dark grayish-brown plow layer, a few areas that have a heavy silty clay loam subsoil, and areas that have slopes of 6 to 12 percent.

There is a moderate hazard of erosion if this soil is used for cultivated crops. All plants commonly grown in this survey area are suited to this soil. The soil is well suited to pasture and hay, and it is used mostly for these purposes. Some of the acreage is used for tobacco and corn. (Capability unit IIe-1; woodland suitability group 1)

Avonburg Series

The Avonburg series consists of deep, somewhat poorly drained, nearly level soils that have a fragipan. The upper part of these soils formed in loamy loess; the lower part formed in calcareous clayey glacial till. These soils are mostly on glaciated uplands in the northeastern part of Boone County.

In a representative profile, the surface layer is 5 inches of dark grayish-brown silt loam that overlies 5 inches of dark-brown friable silt loam. The subsoil to a depth of about 16 inches is yellowish-brown friable silt loam mottled with pale brown and light brownish gray. Below this, to a depth of about 36 inches, is a very firm, compact and brittle fragipan. From about 36 inches to a depth of 50 inches or more is yellowish-brown, firm silty clay mottled with gray and dark brown.

The Avonburg soils have a fragipan that slows water movement and restricts root growth. They are strongly acid in the surface layer, unless limed, and are moderate in natural fertility. Available moisture capacity is moderate, and organic-matter content is low. These soils are easy to till, and they can be worked throughout a wide range of moisture content without crusting or forming clods.

Representative profile of Avonburg silt loam:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; medium acid; clear, smooth boundary.

A1—5 to 10 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; strongly acid; clear, smooth boundary.

B21t—10 to 16 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, pale-brown (10YR 6/3) mottles; weak, medium, angular blocky structure; friable; light brownish-gray (2.5Y 6/2) ped coatings; strongly acid; clear, smooth boundary.

B22t—16 to 24 inches, yellowish-brown (10YR 5/6) silt loam mottled with pale brown (10YR 6/3) in peds; moderate, coarse, prismatic structure parting to weak, medium, angular blocky; very firm; few clay films; light-gray (10YR 7/2) silt coatings on prism faces; strongly acid; gradual, wavy boundary.

IIBx—24 to 36 inches, strong-brown (7.5YR 5/6) silty clay loam mottled with streaks of gray (5Y 6/1) on prism faces and on 20 to 45 percent of blocky ped faces and 3 to 5 percent of inside of peds; moderate, coarse, prismatic structure; few clay films; very firm; brittle and compact; very strongly acid; gradual, wavy boundary.

IIB3—36 to 50 inches +, yellowish-brown (10YR 5/4) silty clay; common, medium, distinct, gray (10YR 5/1) mottles on ped faces and common, fine, faint, brown (10YR 4/3) mottles inside of peds; weak, coarse, blocky structure; firm; very strongly acid.

The solum is 50 to 72 inches thick, but the depth to rock is more than 10 feet. Depth to the fragipan ranges from 21 to 32 inches. The Ap horizon is strongly acid where unlimed. The A horizon colors also include grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4). The B horizon includes hues of 2.5Y. The texture of the IIBx horizon ranges from clay loam to silty clay loam.

The Avonburg soils occur in the same landscape with the Rossmoyne and Jessup soils. The Avonburg soils are less well drained and contain gray mottles nearer the surface than Rossmoyne and Jessup soils. They are coarser textured in the upper part of the solum than Jessup soils, and they have a fragipan, which is lacking in Jessup soils.

Avonburg silt loam (0 to 4 percent slopes) (Av).—This soil is on broad ridgetops in uplands. It occurs in areas 10 to 100 acres in size.

Included in mapping are a few areas on the Ohio River stream terraces that are underlain with mixed silty and loamy alluvium.

There is little or no hazard of erosion, but this soil becomes waterlogged above the slowly permeable fragipan in winter and spring. Water tends to collect on the surface in flat areas. The fragipan hinders the function of field tile in this soil, but open ditch drainage reduces excess wetness.

Cultivated crops and pasture or hay plants that are tolerant to wetness and that can withstand the unfavorable effects of a shallow rooting zone are suited to this soil. Most of the acreage is used for pasture; a small acreage is used for corn and hay. (Capability unit IIIw-1; woodland suitability group 3)

Boonesboro Series

The Boonesboro series consists of soils that are moderately deep to bedrock, well drained, and loamy textured. These soils formed in recent alluvium, mostly of limestone and calcareous shale origin. They occur in narrow stream valleys and are subject to frequent flooding.

In a representative profile, the surface layer is dark-brown silt loam about 21 inches thick. The subsoil, about 9 inches thick, is dark-brown gravelly silt loam. It is underlain by a more gravelly and stony layer that extends to a depth of about 34 inches. Limestone bedrock is beneath this.

The Boonesboro soils have a moderately deep rooting zone. Permeability is moderate in the upper 21 inches and rapid in the lower part. The soils are neutral to mildly alkaline throughout the profile. The organic-matter content is medium, and natural fertility is moderately high. The available moisture capacity is moderate.

Representative profile of Boonesboro silt loam:

Ap—0 to 8 inches, dark-brown (10YR 3/3) silt loam, dark brown (10YR 4/3) when dry; moderate, fine, granular structure; friable; neutral; gradual, smooth boundary.

A1—8 to 21 inches, dark-brown (10YR 3/3) silt loam, dark brown (10YR 4/3) when dry; weak, fine, granular structure; friable; 3 to 5 percent limestone fragments; mildly alkaline; gradual, wavy boundary.

B—21 to 30 inches, dark-brown (10YR 4/3) gravelly silt loam; weak, fine, subangular blocky structure; very friable; 18 percent limestone fragments; mildly alkaline; gradual, smooth boundary.

C—30 to 34 inches, dark-brown (10YR 4/3) very gravelly silt loam; massive; friable; 65 percent limestone channers and pebbles; mildly alkaline; abrupt, smooth boundary.

IIR—34 inches +, limestone bedrock.

The depth to rock ranges from 20 to 40 inches. The content of limestone fragments in the A1 and B horizons ranges from 0 to 30 percent. The A horizon is in hues of 10YR and 2.5Y. The texture of the A horizon is silt loam or silty clay loam. In places the lower part of the B horizon and the C horizon are more than 95 percent gravel. The large increase in content of gravel in the profile is abrupt to gradual.

The Boonesboro soils are associated mainly with Chagrin and Egam soils. They are shallower to bedrock and coarser textured than those soils. They are more gravelly and lighter colored throughout the B horizon than Egam soils.

Boonesboro silt loam (0 to 4 percent slopes) (Bo).—This moderately deep, well-drained soil is in long, narrow areas on first bottoms. The areas are 10 to 30 acres in size.

Included in mapping were some areas that are stony and flaggy, some small areas of sand, areas where depth to bedrock is more than 40 inches, and a few areas where the surface layer is dark grayish brown. Also included are areas where gravel deposits are more than 3 feet thick.

This soil is not suited to cultivation, because of the hazard of flooding during the growing season. Pasture and hay plants that withstand slight droughtiness are suitable to this soil.

Most of the acreage is in grass or second growth hardwood trees. (Capability unit Vw-1; woodland suitability group 2)

Brashear Series

The Brashear series consists of deep, moderately well drained soils that are clayey in the lower part of the subsoil. These soils formed in colluvium or local alluvium that washed mostly from Eden soils. They are on foot slopes, on alluvial fans, at the base of steep hills in valleys, and along many of the larger streams. The slope ranges from 6 to 20 percent.

In a representative profile, the plow layer is dark grayish-brown light silty clay loam about 7 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is olive-brown, firm silty clay loam. Below 18 inches, the subsoil is olive brown and light olive brown, sticky and plastic silty clay to a depth of 60 inches or more.

The Brashear soils have a moderately deep rooting zone and moderately slow permeability. The soils are slightly acid to mildly alkaline in the surface layer and are moderately high in natural fertility. Available moisture capacity is moderate.

Representative profile of Brashear silty clay loam, 12 to 20 percent slopes:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) light silty clay loam; moderate, fine, granular structure and moderate, fine, angular blocky; friable; mildly alkaline; abrupt, smooth boundary.

B21t—7 to 18 inches, olive-brown (2.5Y 4/4) heavy silty clay loam; common, fine, faint, light olive-brown (2.5Y 5/4) mottles and common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, angular blocky structure; firm, slightly sticky; common clay films on peds; mildly alkaline; gradual, wavy boundary.

B22t—18 to 34 inches, olive-brown (2.5Y 4/4) silty clay; common, fine, faint, yellowish-brown (10YR 5/4) mottles, few, fine, faint, yellowish-brown (10YR 5/6) mottles and few, fine, distinct, grayish-brown (2.5Y 5/2) mottles; moderate, medium and coarse, angular blocky structure; firm, sticky and plastic; common clay films on peds; many, small, dark yellowish-brown (10YR 4/4) concretions; mildly alkaline; gradual, wavy boundary.

B23t—34 to 42 inches, light olive-brown (2.5Y 5/4) silty clay; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, coarse, angular blocky structure; firm, sticky and plastic; common clay films; common soft pieces of black material from roots; few small pieces of siltstone; mildly alkaline; gradual, smooth boundary.

B24t—42 to 60 inches +, olive-brown (2.5Y 4/4) silty clay; common, fine, faint, grayish-brown (2.5Y 5/2), light olive-brown (2.5Y 5/4), and yellowish-brown (10YR 5/4) mottles; weak, medium, angular blocky struc-

ture; sticky and plastic when wet; few clay films; common dark-brown concretions; mildly alkaline.

The solum is 36 to more than 60 inches thick. The depth to rock ranges from 4 feet to more than 10 feet. In places a few limestone fragments, 6 to 10 inches across, occur on the surface and in the profile. The color of the Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). The texture of the Ap horizon ranges from silt loam to silty clay. Silty clay textures occur in severely eroded phases.

The B horizon is also dark yellowish brown (10YR 4/4), dark brown (7.5YR 4/4), yellowish brown (10YR 5/4–5/6), or light olive brown (2.5Y 5/4).

These soils have a thicker solum than the defined range for the series, but they do not differ in use and behavior from Brashear soils in other places.

Brashear soils are clayey in the lower part of the B horizon, as are the Jessup, Licking, Eden, and Woolper soils. They have more coarse fragments in the solum than Jessup and Licking soils. They are mottled with gray higher in the B horizon than Jessup soils, and they have a thicker and less acid B horizon than Licking soils. Brashear soils have a thicker solum than Eden soils, and they are lighter colored in the Ap horizon and the upper part of the B horizon than Woolper soils.

Brashear silty clay loam, 6 to 12 percent slopes (BrC).—This soil is on alluvial fans or foot slopes in areas that are 3 to 20 acres in size.

Included in mapping were areas that have a silt loam plow layer that is easy to till. Also included was a small acreage of a soil that has a dark-brown plow layer.

The hazard of erosion is severe if this soil is used for cultivated crops. The organic-matter content is low. The plow layer is somewhat difficult to till because of its moderately fine texture and susceptibility to crusting.

Most of the cultivated crops and pasture or hay plants that are commonly grown in this survey area are suited. This soil is used mostly for hay and pasture; a moderate acreage is used for tobacco and corn. (Capability unit IIIe-2; woodland suitability group 6)

Brashear silty clay loam, 12 to 20 percent slopes (BrD).—This soil is in narrow areas on foot slopes that are below steeper areas of Eden soils. It occurs in areas generally 3 to 20 acres in size. The soil has the profile described as representative for the series.

Included in mapping were small areas that have a silt loam plow layer. Also included were a few flaggy areas.

If this soil is used for cultivated crops, the hazard of erosion is very severe. The organic-matter content is low. The plow layer is difficult to till because of its moderately fine texture. The slope is a limitation for the use of farm machinery. This soil can be cultivated occasionally, but it is better suited to pasture and hay. Most of the acreage is used for hay and pasture, but a small acreage is used for tobacco and corn. (Capability unit IVe–1; woodland suitability group 6)

Brashear silty clay, 12 to 20 percent slopes, severely eroded (BsD3).—This soil is on foot slopes in areas generally 3 to 20 acres in size that are below steeper areas of Eden soils. It has the profile described as representative for the series, except that the original surface soil has been eroded away and the plow layer is dominantly dark yellowish-brown silty clay. Shallow gullies are common.

Included in mapping were a few areas that are stony or flaggy.

The hazard of erosion is too severe for this soil to be used for cultivated crops. Slope and the shallow gullies are limitations for the use of farm machinery. This soil is suited to pasture or hay, but a good stand of grass is moderately difficult to establish because of the clayey plow layer and the very low organic-matter content. The soil is used mostly for hay and pasture; a small acreage is used for gardens and homesites. (Capability unit VIe–1; woodland suitability group 7)

Captina Series

The Captina series consists of deep, moderately well drained soils that have a fragipan. These soils formed in alluvium dominantly of limestone origin. They are mostly on old, high stream terraces along the Licking River and in the central part of Campbell County. The slope ranges from 2 to 12 percent.

In a representative profile, the plow layer is dark-brown silt loam about 7 inches thick. The upper part of the subsoil consists of a thin layer of yellowish-brown silt loam overlying a thicker layer of yellowish-brown silty clay loam. At a depth of 20 inches, there is a mottled, yellowish-brown, very firm, compact and brittle fragipan that becomes grayer and more mottled to a depth of 50 inches or more.

The Captina soils are moderately deep to a fragipan that slows water movement and restricts root growth. These soils are strongly acid in the surface layer where unlimed, and they are moderate in natural fertility. The available moisture capacity is moderate, and the organic-matter content is low. The soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Captina silt loam, 2 to 6 percent slopes:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; slightly acid; clear, smooth boundary.

B1—7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B2t—10 to 20 inches, yellowish-brown (10YR 5/6) silty clay loam; few, fine, faint, light yellowish-brown (10YR 6/4) mottles; moderate, medium, subangular blocky structure; friable; few clay films; strongly acid; gradual, smooth boundary.

Bx1—20 to 30 inches, yellowish-brown (10YR 5/6) heavy silt loam or light silty clay loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles and few, fine, faint, light-gray (10YR 7/1) mottles; weak, very coarse, prismatic structure parting to moderate, coarse, angular blocky; very firm, slightly brittle and compact; few clay films; strongly acid; common, fine and medium, dark-brown concretions; clear, smooth boundary.

Bx2—30 to 42 inches, mottled light-gray (10YR 7/1), gray (10YR 6/1), and yellowish-brown (10YR 5/8) silty clay loam; moderate, very coarse, prismatic structure parting to coarse, angular blocky; very firm, compact and brittle; many dark concretions; strongly acid; gradual, wavy boundary.

Cx—42 to 50 inches +, light-gray (10YR 7.1) silty clay loam; common, fine, distinct, strong-brown (7.5YR 5/8) and yellowish-brown (10YR 5/4) mottles; massive to weak, coarse, prismatic structure; firm, brittle and compact; common, dark concretions; strongly acid.

The solum is 34 to 48 inches thick, and the depth to rock is more than 10 feet. The depth to the fragipan is 18 to 22 inches. The Ap and B1 horizons are strongly acid where un-

limed. The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3); in eroded places dark yellowish-brown or yellowish-brown soil material is mixed in. The B1 horizon is dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6 or 5/4), or brown (7.5YR 4/4). The B2 horizon is brown (7.5YR 5/6) or yellowish brown (10YR 5/6).

Captina soils occur with Licking and Lawrence soils. Unlike the Licking soils, they have a fragipan and are coarser textured throughout the solum. Captina soils are better drained than Lawrence soils and lack gray mottles in the upper 10 inches of the subsoil. They are similar to Rossmoyne soils, but they have a thinner solum and are underlain by alluvium, rather than by the clayey glacial till that underlies Rossmoyne soils.

Captina silt loam, 2 to 6 percent slopes (CaB).—This soil is on stream terraces generally in areas 5 to 20 acres in size. It has the profile described as representative for the series.

Included in mapping were areas where the slope is 0 to 2 percent and areas that are eroded and have a shallow rooting zone.

The hazard of erosion is moderate where this soil is cultivated. Permeability is slow in the fragipan.

Cultivated crops and pasture and hay plants that have a moderately deep rooting system and can withstand slight wetness during the early part of the growing season are suited to this soil. The soil is used mostly for hay and pasture, but a large acreage is used for tobacco and corn. (Capability unit IIe–3; woodland suitability group 4)

Captina silt loam, 6 to 12 percent slopes (CaC).—This soil is on old stream terraces. The areas are long and narrow and are about 2 to 10 acres in size. It has the profile described as representative for the series, except that the plow layer is dark grayish brown mixed with yellowish brown or, where not mixed, the surface layer is less than 6 inches thick.

Including in mapping were a few areas where most of the topsoil has been removed by erosion. Also included were a few seepy spots where the fragipan is near the surface.

The hazard of erosion is severe if this soil is cultivated. Permeability is slow in the fragipan. Cultivated crops and pasture or hay plants that need only a moderately deep rooting zone are suited to this soil. The soil is used mostly for hay and pasture, but a small acreage is used for tobacco and corn. (Capability unit IIIe–3; woodland suitability group 4)

Chagrin Series

The Chagrin series consists of nearly level, deep, well-drained gravelly soils that developed in recent alluvium mostly of limestone and calcareous shale origin. These soils occur on flood plains along small streams in the county.

In a representative profile, the surface layer is dark grayish-brown gravelly silty clay loam about 8 inches thick. The subsoil, to a depth of about 22 inches, is brown gravelly silty clay loam. This is underlain by dark grayish-brown gravelly silty clay loam extending to a depth of 50 inches or more.

The Chagrin soils have a deep rooting zone and moderate permeability. They are neutral in reaction to a depth of about 30 inches, and they are high in natural fertility. Available moisture capacity is moderate, and organic-matter content is medium. The gravel hinders tilling which must be done within a narrow range of moisture content to prevent clodding.

Representative profile of Chagrin gravelly silty clay loam:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly silty clay loam; moderate, fine, granular structure and very fine, subangular blocky; friable; neutral; gradual, smooth boundary.

B—8 to 30 inches, brown (10YR 4/3) gravelly silty clay loam; weak, fine, subangular blocky structure; firm; about 20 percent coarse fragments; neutral; gradual, smooth boundary.

C—30 to 50 inches +, dark grayish-brown (10YR 4/2) gravelly silty clay loam; common, fine, faint, grayish-brown (2.5Y 5/2) mottles; friable; 30 percent coarse fragments; weak, medium, subangular blocky structure; mildly alkaline.

The depth to rock ranges from 4 to 10 feet. The Ap horizon contains 10 to 30 percent limestone and siltstone fragments. The B and C horizons contain 20 to 35 percent coarse fragments. Colors of the soil throughout are in hues of 10YR and 2.5Y. The texture of the A and C horizon is dominantly light silty clay loam that is about 28 percent clay. Reaction is neutral to moderately alkaline.

These soils have a finer textured A horizon and are more alkaline than the defined range for the series, but they do not differ in use and behavior from Chagrin soils in other places.

The Chagrin soils occur with the Boonesboro, Nolin, and Egam soils. Chagrin soils are deeper to bedrock and are finer textured throughout than Boonesboro soils. They are more gravelly than Egam and Nolin soils. Also, they have a finer textured solum than Nolin soils and are lighter colored than Egam soils.

Chagrin gravelly silty clay loam (0 to 4 percent slopes) (Cg).—This soil is on flood plains in long, narrow areas 10 to 20 acres in size.

Included in mapping were a few small stony areas and a few small areas of soils that have channery profiles.

There is no hazard of erosion, and all cultivated crops and pasture or hay plants that are commonly grown in this survey area are well suited to this soil. The soil is susceptible to flooding in winter and spring, but the crops are seldom damaged. Most of this soil is in grass; some is used for gardens or corn. (Capability unit IIs–1; woodland suitability group 2)

Chavies Series

The Chavies series consists of deep, well-drained, loamy soils. These soils developed in sandy alluvium on stream terraces along the Ohio River. Slope ranges from 0 to 12 percent.

In a representative profile, the plow layer is dark-brown fine sandy loam about 9 inches thick. The subsoil, about 31 inches thick, is dark yellowish-brown, yellowish-brown, and dark-brown very friable fine sandy loam. The underlying loose, yellowish-brown sand begins at a depth below 40 inches.

The Chavies soils have a deep rooting zone and moderately rapid permeability. The soils are strongly acid unless limed, and they are moderate in natural fertility. Available moisture capacity is high, and organic-matter content is low. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Chavies fine sandy loam, 0 to 6 percent slopes:

Ap—0 to 9 inches, dark-brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; very friable; strongly acid; clear, smooth boundary.

B11—9 to 16 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, fine, subangular blocky structure; very friable; strongly acid; clear, smooth boundary.

B12—16 to 22 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, subangular blocky structure; very friable; strongly acid; clear, smooth boundary.

B21t—22 to 30 inches, yellowish-brown (10YR 5/6) light sandy clay loam; common, fine, faint, light yellowish-brown (10YR 6/4) mottles; weak, medium, subangular blocky structure; very friable; few patchy clay films; strongly acid; clear, smooth boundary.

B22t—30 to 40 inches, dark-brown (7.5YR 4/4) fine sandy loam; few, fine faint, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; very friable; few thin patchy clay films; strongly acid; abrupt, smooth boundary.

C—40 to 50 inches +, yellowish-brown (10YR 5/4) fine sand; single grain; loose; strongly acid.

The solum ranges from 30 to 48 inches in thickness; depth to rock is more than 10 feet. The texture of the A horizon is mostly fine sandy loam, but it ranges from fine sandy loam to sandy loam. The B horizon colors include hues of 10YR and 7.5YR, and the texture is fine sandy loam, loam, and light sandy clay loam. The C horizon is loamy sand or fine sand; in some profiles it is gravelly.

The Chavies soils occur in the same landscape with the Ashton, Wheeling, Huntington, and Lakin soils. Chavies soils have a lighter colored Ap horizon and are sandier throughout the solum than Ashton and Huntington soils. They are lower in silt and clay content than Wheeling soils but contain more clay and less sand than Lakin soils. Also, they have a more strongly expressed B horizon that lacks contrasting bands in comparison with Lakin soils.

Chavies fine sandy loam, 0 to 6 percent slopes (ChB).—This soil is on broad areas of stream terraces in areas that generally range from 5 to 20 acres in size. The soil has the profile described as representative for the series.

There is a moderate hazard of erosion if this soil is cultivated. The soil is well suited to all the cultivated crops and pasture or hay plants common in the survey area. It is used mostly for hay but occasionally for corn. A small acreage is used for vegetables and fruit trees. (Capability unit IIe–1; woodland suitability group 1)

Chavies fine sandy loam, 6 to 12 percent slopes (ChC).—This soil is in narrow areas on stream terraces along the Ohio River. Areas generally range from 5 to 50 acres in size.

The hazard of erosion is severe if the soil is cultivated.

Most of the cultivated crops and pasture or hay plants common in the survey area are suited to this soil. The soil is used mostly for hay and pasture. (Capability unit IIIe–1; woodland suitability group 1)

Cynthiana Series

The Cynthiana series consists of shallow, somewhat excessively drained soils that have a flaggy, clayey subsoil (fig. 6). These soils formed in residual material that weathered from limestone interbedded with some calcareous shale. They occur on hillsides and range in slope from 12 to about 50 percent. Most areas are in the hilly northern part of Boone County.

In a representative profile, the plow layer is dark-brown flaggy silty clay loam about 4 inches thick. The subsoil, about 8 inches thick, is dark yellowish-brown, firm, sticky and plastic flaggy silty clay. At a depth below 12 inches is yellowish-brown, firm flaggy silty clay underlain by limestone at a depth of about 18 inches.

Figure 6.—**Cynthiana flaggy silty clay loam is shallow to limestone bedrock.**

The Cynthiana soils have a shallow rooting zone and moderately slow permeability. They are neutral to mildly alkaline throughout the profile; they are moderately high in natural fertility. Available moisture capacity is low, and organic-matter content is medium.

Representative profile of Cynthiana flaggy silty clay loam, 12 to 20 percent slopes:

Ap—0 to 4 inches, dark-brown (10YR 3/3) flaggy silty clay loam, light brownish gray (10YR 6/2) when dry; moderate, medium, granular structure; firm; neutral; clear, smooth boundary.

B2t—4 to 12 inches, dark yellowish-brown (10YR 4/4) flaggy silty clay; strong, medium, angular blocky structure;

firm, sticky and plastic; common clay films; mildly alkaline; gradual, smooth boundary.

C—12 to 18 inches, yellowish-brown (10YR 5/4) flaggy silty clay; common, fine, faint, olive-brown (2.5Y 4/4) mottles; massive; firm, sticky and plastic; moderately alkaline, weakly calcareous; abrupt, wavy boundary.

R—18 inches +, highly fossiliferous limestone.

The solum ranges from 8 to 16 inches in thickness. Depth to limestone is 12 to 20 inches. Thin flagstones cover 5 to 30 percent of the surface and make up as much as 20 percent of the profile. The texture of the Ap horizon is silty clay loam in uneroded areas and silty clay in eroded areas. The B horizon is dark yellowish brown (10YR 4/4), brown (10YR 4/3), dark yellowish brown (10YR 3/4), yellowish brown (10YR 5/6), or olive brown (2.5Y 4/4). The texture of the B and C horizons is silty clay or clay.

Cynthiana soils occur with Faywood, Jessup, and Eden soils. They are shallower to bedrock and contain more coarse fragments than those soils.

Cynthiana flaggy silty clay loam, 12 to 20 percent slopes (CyD).—This soil is mostly on upper hillsides in narrow areas that range from 5 to 30 acres in size. It has the profile described as representative for the series.

Included in mapping are a few small areas where limestone crops out, a few nonflaggy areas, and a few small areas where the rooting zone is less than 10 inches thick.

The hazard of erosion is too severe for this soil to be used for cultivated crops. The slope and flagstones hinder the use of machinery. This soil is suited to pasture or hay if the grasses and legumes are those that withstand droughtiness. The soil is used mostly for pasture, but some areas are in second-growth trees. (Capability unit VIe–1; woodland suitability group 7)

Cynthiana flaggy silty clay loam, 20 to 50 percent slopes (CyF).—This soil is on upper hillsides in areas that are generally 50 to 500 acres in size.

Included in mapping were small areas of Faywood soils that are more than 20 inches deep. Small areas of limestone outcrop and very small nonflaggy areas were also included.

The hazard of erosion on this soil is too severe for cultivated crops. The slope hinders the use of farm machinery. This soil is not suited to hay, because of the slope. Its suitability for pasture is limited because of shallowness and droughtiness. Woodland is a better use. Most of the acreage is in second-growth trees, but a few acres are cleared and used for pasture. (Capability unit VIIe–1; woodland suitability group 7)

Eden Series

The Eden series consists of deep, well-drained, somewhat droughty soils that have a clayey subsoil. These soils formed in residual material that weathered from soft calcareous shale, thin layers of limestone, and beds of siltstone. They occur on very narrow ridges and side slopes in highly dissected areas. The slope ranges from 12 to 35 percent.

In a representative profile, the plow layer is dark-brown light silty clay loam about 5 inches thick. The subsoil, about 8 inches thick, is dark yellowish-brown, firm, sticky and plastic silty clay. It is underlain, at a depth of 13 inches, by light olive-brown silty clay and olive-gray silty clay that extends to a depth of 50 inches or more. Below a depth of about 24 inches, this soil is very flaggy.

Eden soils have a moderately deep rooting zone. They are slowly permeable and slightly acid to neutral throughout the solum, and natural fertility is moderately high. Available moisture capacity is moderate, and organic-matter content is very low.

Representative profile of Eden silty clay loam, 12 to 20 percent slopes, eroded:

Ap—0 to 5 inches, dark-brown (10YR 4/3) light silty clay loam; weak, fine, granular structure; firm; slightly acid; clear, smooth boundary.

B2t—5 to 13 inches, dark yellowish-brown (10YR 4/4) silty clay; common, fine, faint, light olive-brown (2.5Y 5/6) mottles; strong, fine and medium, angular blocky structure; firm, sticky and plastic; common clay films; neutral; gradual, smooth boundary.

C—13 to 24 inches, light olive-brown 2.5Y 5/4) silty clay; common, fine, faint, olive-brown (2.5Y 4/4), light yellowish-brown (2.5Y 6/4), and grayish-brown (2.5Y 5/2) mottles; massive to weak, medium, platy structure; firm, sticky and plastic; few fragments of soft shale; moderately alkaline; abrupt, smooth, discontinuous boundary.

C2—24 to 50 inches +, olive-gray (5Y 5/2) to light olive-brown (2.5Y 5/4) silty clay; many yellowish-brown, strong-brown, and grayish-brown mottles; moderate, thick to very thick, platy structure; firm, sticky and plastic; 50 to 60 percent of volume is fragments of calcareous shale, limestone, and siltstone; moderately alkaline.

The solum is 13 to 25 inches thick, and depth to unweathered rock is 40 to 60 inches. The B horizon is 8 to 16 inches thick. The Ap horizon is dark brown (10YR 4/3), dark grayish brown (10YR 4/2 or 2.5Y 4/2), and olive brown (2.5Y 4/2). The texture of the A horizon ranges from light silty clay loam to silty clay. The B horizon is olive brown (2.5Y 4/4), light olive brown (2.5Y 5/4), yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), or olive brown (2.5Y 4/4).

Eden soils occur with the Brashear, Cynthiana, Faywood, and Jessup soils. They have a thinner solum than Brashear, Faywood, and Jessup soils. They are deeper to bedrock than Cynthiana soils. Their subsoil has more olive colors than Faywood and Jessup soils.

Eden silty clay loam, 12 to 20 percent slopes, eroded (EdD2).—This soil is on narrow ridges and upper hillsides in narrow areas generally 10 to 100 acres in size. It has the profile described as representative for the series.

Included in mapping were some severely eroded areas, areas in which depth to bedrock is less than 40 inches, areas on narrow ridges where the slope is 6 to 12 percent, and areas where a layer of loess, 3 to 4 inches thick, is on the surface. Also included were areas where flagstones are on the surface and in the profile, and some areas where the B horizon is discontinuous or is lacking.

The hazard of erosion is too severe for cultivation. The slope hinders the use of farm machinery. The soil is well suited to pasture or hay if grasses and legumes that withstand moderate droughtiness are grown. Most of the acreage is used for pasture; a few acres are used for tobacco and corn. (Capability unit VIe–1; woodland suitability group 7)

Eden silty clay loam, 20 to 35 percent slopes, eroded (EdE2).—This soil is on hillsides in large areas, sometimes thousands of acres in size.

Included in mapping were some areas where slope is greater than 35 percent. Also included were a few areas that have a silt loam surface, some areas that have flagstones on the surface and in the profile, and some areas that have discontinuous B horizons.

The hazard of erosion is too severe for cultivated crops. Steepness is a limitation for the use of farm machinery. This soil is suited to pasture if grasses and legumes that withstand moderate droughtiness are grown. Some areas are used for pasture; many areas are idle. A large acreage is in scrub trees, but only a very small acreage is woodland of commercial value. One area in Campbell County is used for Christmas trees (fig. 7). (Capability unit VIe–1; woodland suitability group 7)

Egam Series

The Egam series consists of deep, moderately well drained soils that formed in moderately fine textured to fine textured alluvium mostly of limestone origin. These nearly level soils occur on flood plains along many streams in the survey area.

In a representative profile, the plow layer is very dark grayish-brown silty clay loam about 7 inches thick. The subsoil, about 37 inches thick, is dark-brown and very dark grayish-brown, firm heavy silty clay loam. Below this, and extending to a depth of 50 inches or more, is very dark grayish-brown heavy silty clay loam.

The Egam soils have a deep rooting zone and moderately slow permeability. They are neutral to mildly alkaline throughout the profile, and they are high in natural fertility. Available moisture capacity is high, and organic-matter content is high. These soils are difficult to till because they are moderately fine textured.

Representative profile of Egam silty clay loam:

Ap—0 to 7 inches, very dark grayish-brown (2.5Y 3/2) silty clay loam, grayish brown (2.5Y 5/2) when dry; moderate, medium and fine, granular structure; firm; neutral; clear, smooth boundary.

B21t—7 to 13 inches, dark-brown (10YR 3/3) heavy silty clay loam, grayish brown (10YR 5/2) when dry; moderate, fine, blocky structure; firm, sticky and plastic; mildly alkaline; gradual, smooth boundary.

B22—13 to 44 inches, very dark grayish-brown (10YR 3/2) heavy silty clay loam; few, fine, faint, grayish-brown (2.5Y 4/2) mottles; moderate, medium, subangular blocky structure and moderate, medium, granular; firm, slightly compact, sticky and plastic; mildly alkaline; gradual, smooth boundary.

B23—44 to 50 inches +, very dark grayish-brown (2.5Y 3/2) heavy silty clay loam; weak to moderate, medium, angular blocky; firm, sticky and plastic; mildly alkaline.

The depth to rock is more than 10 feet. Texture of the Ap horizon is dominantly silty clay loam but is silt loam in places. Below the Ap horizon the texture is heavy silty clay loam or silty clay. These Egam soils have a lower temperature than the defined range for the series, but they do not differ in usefulness or behavior from Egam soils in other places.

Egam soils occur with Huntington, Lindside, Ashton, and Woolper soils. They are finer textured than Huntington, Lindside, and Ashton soils, but they are generally coarser textured in the subsoil than Woolper soils. Their subsoil lacks clay films, which occur in the subsoil of Woolper soils.

Figure 7.—Plantation of Christmas trees on an Eden silty clay loam.

Egam silty clay loam (0 to 4 percent slopes) (Eg).—This soil is on flood plains in areas that are generally narrow and range from 3 to 30 acres in size.

Included in mapping were areas that have a dark grayish-brown surface layer and subsoil. Also included were small, scattered areas of Brashear and Woolper soils.

There is little or no hazard of erosion on this soil. Most plants commonly grown in this survey area grow well on this soil. Flooding in winter and spring is a limitation, but summer crops are seldom damaged during the growing season. Because of the moderately fine textured surface layer, plowing must be done within a narrow range of moisture content to prevent clodding.

The soil is used mostly for hay and pasture, but a large acreage is used for corn and tobacco. (Capability unit IIs–1; woodland suitability group 2)

Faywood Series

The Faywood series consists of well-drained soils that are on narrow ridges and upper hillsides. They are moderately deep to bedrock and have a clayey lower subsoil. They formed in residual material that weathered from limestone interbedded with calcareous shale. Slope ranges from 2 to 20 percent.

In a representative profile, the surface layer is dark grayish-brown silty clay loam about 3 inches thick. The subsoil is about 24 inches thick. The upper 4 inches is yellowish-brown silty clay loam. Three lower subsoil layers, 6, 5, and 9 inches thick, respectively, consist of yellowish-brown, firm, heavy silty clay loam over about 9 inches of light yellowish-brown, firm, sticky and plastic clay. Below these layers, at a depth of 27 inches, is a layer of mottled, light olive-brown, sticky and plastic clay extending to limestone bedrock at a depth of about 36 inches.

The Faywood soils have a moderately deep rooting zone and moderately slow permeability. These soils are medium acid to slightly acid throughout the solum unless limed, and they are moderate in natural fertility. Available moisture capacity is moderate.

Representative profile of Faywood silty clay loam, 6 to 12 percent slopes:

Ap—0 to 3 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3) light silty clay loam; moderate, fine and medium, granular structure; friable; neutral; clear, smooth boundary.

B1—3 to 7 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, fine and medium, subangular blocky structure; friable; neutral; clear, smooth boundary.

B21t—7 to 13 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; moderate, medium, subangular blocky structure; firm; common clay films; slightly acid; clear, smooth boundary.

B22t—13 to 18 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, fine, faint, light yellowish-brown (10YR 6/4) mottles; moderate, medium, subangular blocky structure; firm; common clay films; slightly acid; clear, smooth boundary.

B3t—18 to 27 inches, light yellowish-brown (10YR 6/4) clay; few, fine, faint, yellowish-brown (10YR 5/6) mottles and common, fine, distinct, pale-brown (10YR 6/3) mottles; weak, medium, angular blocky structure; few clay films; firm, sticky and plastic; medium acid; clear wavy boundary.

C—27 to 36 inches, light olive-brown (2.5Y 5/4) clay; common, fine, faint, light olive-brown (2.5Y 5/6) mottles, and common, fine, distinct, light brownish-gray (2.5Y 6/2) mottles; massive; firm, sticky and plastic; common, small, dark concretions; slightly acid to neutral; abrupt, wavy boundary.

R—36 inches +, limestone.

The solum ranges from 24 to 36 inches thick, and depth to limestone is 20 to 40 inches. In a few places the Ap horizon is dark brown (10YR 3/3) and less than 6 inches thick. The texture of the Ap horizon ranges from silt loam to silty clay loam. It is silty clay in severely eroded places. The B1 horizon is yellowish brown (10YR 5/6), dark brown (7.5YR 4/4), and dark yellowish brown (10YR 4/4). The B2 horizon is strong brown (7.5YR 5/6) or yellowish brown (10YR 5/4 to 5/8).

Faywood soils are clayey in the lower part of the subsoil, as are Jessup, Licking, Eden, and Cynthiana soils. They are shallower to bedrock than Jessup, Licking, and Eden soils. Faywood soils have a thinner solum than Jessup soils but a thicker one than the Eden soils. They are deeper to bedrock and have a thicker solum than Cynthiana soils.

Faywood silt loam, 2 to 6 percent slopes (FaB).—This soil is on narrow ridgetops in areas that are 2 to 10 acres in size. It has the profile described as representative for the series, except that the surface layer is 4 to 6 inches thick.

Included in mapping were a few areas that have a yellowish-red subsoil.

There is a moderate hazard of erosion if cultivated crops are grown. Organic-matter content is low. The plow layer is generally easy to till except for a few small areas that are eroded and clayey. All the cultivated crops and pasture or hay plants common in the survey area are suited to this soil. Most of the acreage is used for hay and pasture, but a fairly large acreage is used for tobacco, corn, gardens, and homesites. (Capability unit IIe–2; woodland suitability group 6)

Faywood silty clay loam, 6 to 12 percent slopes (FcC).—This soil is on fairly narrow ridgetops that have convex slopes. The areas range from 10 to 50 acres in size. The soil has the profile described as representative for the series.

Included in mapping were a few areas where the depth to rock is more than 40 inches. Also included were a few small areas that have a yellowish-red subsoil.

The hazard of erosion is severe if this soil is used for cultivated crops. Organic-matter content is low. The plow layers are more difficult to till than Faywood silt loam because of moderately fine texture; the surface is subject to crusting after showers. Most of the cultivated crops and pasture or hay plants common in the survey area are suited to this soil. Most of the acreage is used for hay and pasture, but a small acreage is used for tobacco and corn. (Capability unit IIIe–2; woodland suitability group 6)

Faywood silty clay loam, 12 to 20 percent slopes (FcD).—This soil is on upper hillsides in long, narrow areas that are several hundred acres in size in many places.

Included in mapping were a few areas where depth to rock is more than 40 inches.

The hazard of erosion is very severe if this soil is cultivated. Organic-matter content is low. The plow layer is more difficult to till than that of Faywood silt loam because of the moderately fine texture. The slope hinders the use of farm machinery. This soil is better suited to pasture or hay than to row crops, but it can be cultivated occasionally. Most of the cultivated crops and pasture and

hay plants common in the survey area are suited to this soil. This soil is used for mostly for pasture, but a few acres are used for corn and tobacco. (Capability unit IVe–1; woodland suitability group 6)

Faywood silty clay, 12 to 20 percent slopes, severely eroded (FdD3).—This soil is on upper hillsides in long, narrow areas that are several hundred acres in size in many places. It has the profile described as representative for the series, except that most of the original surface layer has washed away. Shallow gullies are common in some areas.

The hazard of erosion is too severe for this soil to be used for cultivated crops. Organic-matter content is very low. The slope and the shallow gullies hinder the use of farm machinery. The soil is suited to pasture or hay. Grasses and legumes that withstand moderate droughtiness are best suited to this soil. Most of the acreage is used for pasture, but some areas are idle and a few small areas are used for tobacco or corn. (Capability unit VIe–1; woodland suitability group 7)

Gullied Land

Gullied land (Gu) consists of very severely eroded areas that are characterized by an intricate pattern of moderately deep or deep gullies. The original properties of the soils have been destroyed except in small areas between the gullies. Included are areas where sheet erosion has entirely or almost entirely removed the soil and exposed substrata material.

This land type is generally not suited to crops or hay. It is better suited to woodland, to pasture used for limited grazing, or to wildlife habitat. Most areas are neutral to alkaline in reaction. (Capability unit VIIe–2; woodland suitability group 8)

Huntington Series

The Huntington series consists of deep, well-drained, nearly level soils on the flood plains along the Ohio River. These soils formed in recent alluvium.

In a representative profile, the surface layer is dark-brown silt loam about 10 inches thick. The subsoil, which extends to a depth of 50 inches or more, is dark-brown silt loam. The soil is friable throughout.

The Huntington soils have a deep rooting zone and are moderately permeable. They are neutral to mildly alkaline throughout and are high in natural fertility. Available moisture capacity is high, and organic-matter content is high. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding or crusting.

Representative profile of Huntington silt loam:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) when dry; moderate, medium, granular structure; friable; neutral; gradual, smooth boundary.

B21—10 to 18 inches, dark-brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) when dry; weak, fine, subangular blocky structure; friable; neutral; gradual, wavy boundary.

B22—18 to 50 inches +, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; neutral.

The depth to rock is commonly more than 10 feet. Thickness of the combined upper horizons that have a color value of 3 ranges from 14 to 24 inches. Reaction is neutral to mildly alkaline in all horizons. The Ap horizon is very dark grayish brown (10YR 3/2), and there are no gray mottles within 30 inches of the surface.

Some of the Huntington soils in this survey area are sandier throughout the solum than the defined range for the series, but they do not differ significantly in use and behavior from Huntington soils in other places.

Huntington soils occur with Lindside and Egam soils. They are free of gray mottles to a greater depth and have a darker color plow layer than the moderately well drained Lindside soils. Huntington soils are coarser textured throughout than the moderately well drained Egam soils. They are similar to Nolin soils, but they are darker colored in the Ap horizon and in the upper part of the B horizon.

Huntington fine sandy loam (0 to 4 percent slopes) (Hn).—This soil is on the flood plains of the Ohio River in areas 50 to 75 acres in size. It has the profile described as representative for the series, except that the texture is fine sandy loam throughout.

Included in mapping were small areas where slope is more than 4 percent. The hazard of erosion is slight, and the soil is suited to all cultivated crops and pasture or hay plants commonly grown in this survey area. Flooding during the winter and spring is a limitation, but crops are seldom damaged during the summer growing season.

Most of this soil is in grass, a large acreage is used for corn, a few areas are idle, and a few acres are used for gardens. (Capability unit I–1; woodland suitability group 2)

Huntington silt loam (0 to 4 percent slopes) (Hu).—This soil is on the flood plains of the Ohio River in narrow areas that are 5 to 50 acres in size. It has the profile described as representative for the series.

Included in mapping were small areas where the slope is more than 4 percent, as well as some areas where the surface layer is thicker than is typical for the series.

The hazard of erosion is slight and all cultivated crops and pasture or hay plants that are commonly grown in this survey area are well suited to this soil. Flooding during winter and spring is a limitation, but the crops are seldom damaged during the summer growing season.

Most of this soil is in grass, a large acreage is used for corn, a few acres are idle, and a few acres are used for gardens. (Capability unit I–1; woodland suitability group 2)

Jessup Series

The Jessup series consists of deep, well-drained soils that are clayey in the lower part of the subsoil. The upper layers of these soils formed in loess, and the lower layers formed in glacial till. These soils occur on narrow ridges and hillsides. The slope ranges from 2 to 30 percent.

In a representative profile, the surface layer is dark grayish-brown silt loam about 4 inches thick. The subsoil, in sequence from the top, consists of 6 inches of yellowish-brown light silty clay loam, 5 inches of yellowish-brown, firm silty clay loam, 17 inches of yellowish-brown, sticky and plastic silty clay, and 12 inches of light olive-brown, plastic silty clay. At a depth below 44 inches, and to a depth of 60 inches or more, is light olive-brown, sticky and plastic silty clay.

The Jessup soils have a deep rooting zone and moderately slow permeability. The upper layers of these soils are medium acid to strongly acid unless limed. The soils are moderate in natural fertility. Available moisture capacity is high.

Representative profile of Jessup silt loam, 12 to 20 percent slopes:

Ap—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; neutral; abrupt, wavy boundary.

B1t—4 to 10 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, fine and medium, subangular blocky structure; firm; few clay films; few small dark patches of silt; neutral; gradual, wavy boundary.

B21t—10 to 15 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; few, fine, faint, light yellowish-brown 10YR 6/4) mottles and few, fine, faint, strong-brown (7.5YR 5/6) mottles; moderate, medium, angular blocky structure; firm, slightly sticky; common clay films; slightly acid; gradual, wavy boundary.

IIB22t—15 to 32 inches, yellowish-brown (10YR 5/6) silty clay; moderate to strong, angular blocky structure; firm, slightly sticky and slightly plastic; pale-brown (10YR 6/3) silt coatings on some peds; common clay films; few small fragments of chert; common soft concretions; medium acid; gradual, wavy boundary.

IIB31t—32 to 38 inches, light olive-brown (2.5Y 5/6) silty clay; weak, medium, angular blocky structure; firm, sticky and plastic; few patches of light gray (N 7/0); slightly acid; abrupt, wavy boundary.

IIB32t—38 to 44 inches, light olive-brown (2.5Y 5/4 or 5/6) silty clay; few, fine, distinct, light brownish-gray (2.5Y 6/2) and light-gray (2.5Y 7/2) mottles; strong, fine, angular blocky structure; firm, sticky and plastic; neutral; gradual, wavy boundary.

IIIC1—44 to 60 inches +, light olive-brown (2.5Y 5/4) silty clay; moderate, thick, platy structure; very firm, sticky and plastic; common, soft, dark pieces of concretionary material or carbon from decayed roots; neutral.

The solum ranges from 38 to 50 inches in thickness, and the depth to rock ranges from 4 to more than 10 feet. In places a few small pieces of chert, quartz, and other glacial pebbles occur in the IIB3 horizons. The Ap horizon is dark brown (10YR 4/3). In places where an A1 horizon is present, it is dark brown (10YR 3/3) but less than 6 inches thick. The texture of the Ap horizon is silt loam, except in severely eroded places, where it is silty clay loam. The B horizon is dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4), dark brown (7.5YR 4/4), reddish brown (5YR 4/4), strong brown (7.5YR 5/6), or olive brown (2.5Y 4/4).

The lower part of the subsoil of Jessup soils is clayey, as is the lower part of the subsoil of the Faywood, Brashear, Eden, and Licking soils. Jessup soils are deeper to bedrock and have a thicker solum than Faywood soils. They lack the coarse fragments that are in Brashear soils, and they are deeper to gray mottling. They have a thicker solum than Eden soils and are better drained than Licking soils.

Jessup silt loam, 2 to 6 percent slopes (JeB).—This soil is on fairly narrow ridges and upper side slopes in areas that are generally 5 to 10 acres in size. It has the profile described as representative for the series, except that the surface layer is 6 to 8 inches thick.

Included in mapping were small areas of soils 36 to 40 inches deep over rock.

The hazard of erosion is moderate if cultivated crops are grown. Organic-matter content is medium. The soil is easy to till, and it can be worked throughout a wide range of moisture content without clodding.

All cultivated crops and pasture or hay plants common in the survey area are suited to this soil. The soil is used mostly for pasture, but a fairly large acreage is used for tobacco, gardens, and community development. (Capability unit IIe–2; woodland suitability group 6)

Jessup silt loam, 6 to 12 percent slopes (JeC).—This soil is in narrow bands, commonly below broad ridges of Rossmoyne soils. Areas are generally 10 to 40 acres in size.

Included in mapping were small areas where the surface layer is 6 to 8 inches thick. Also included were small areas that have a thin surface layer of dark grayish-brown silt loam underlain by a subsoil of gravelly clay loam or sandy clay that is nearly neutral in reaction.

The hazard of erosion is severe if the soil is used for cultivated crops. Organic-matter content is generally low. Tillage is hindered in some places by the moderately fine texture of the lower part of the plow layer. The surface is susceptible to crusting after showers.

Most cultivated crops and pasture or hay plants common in the survey area are well suited to this soil. The soil is used mostly for hay and pasture, but a small acreage is used for tobacco and corn. (Capability unit IIIe–2; woodland suitability group 6)

Jessup silt loam, 12 to 20 percent slopes (JeD).—This soil occurs on upper hillsides below broad ridges of Rossmoyne soils. The areas are narrow, but many are several hundred acres in size. The soil has the profile described as representative for the series.

Included in mapping were small areas that have a surface layer 6 to 8 inches thick; areas that have a subsoil of nearly neutral gravelly clay loam or sandy clay loam; and a few areas that have a surface layer of loess more than 20 inches thick underlain by sandy clay loam. Also included were areas where there are outcrops of limestone conglomerate.

The hazard of erosion is severe if this soil is used for cultivated crops, but the soil can be cultivated occasionally. Organic-matter content is low. The plow layer is difficult to till because of the moderately fine texture of the lower part. The slope is a limitation for the use of farm machinery, and the soil is therefore better suited to pasture or hay than row crops. Most of the grasses and legumes common in the survey area are suited to this soil. The soil is used mostly for pasture. To a lesser extent, it is used for cultivated crops, building sites, and roads. (Capability unit IVe–1; woodland suitability group 6)

Jessup silt loam, 20 to 30 percent slopes (JeE).—This soil is on upper hillsides in areas generally 50 to 150 acres in size.

Included in mapping were areas underlain by yellowish-red calcareous sandy clay. Also included were small areas where the slope is more than 30 percent, small gullied areas, narrow areas where the slope is less than 20 percent, and a few areas of outcrops of limestone conglomerate.

The hazard of erosion is too severe for this soil to be used for cultivated crops. Slope is a limitation for the use of farm machinery. Organic-matter content is low. Pasture is a suitable use of this soil and most of the grasses and legumes common in the survey area are suited to this soil. The soil is used mostly for pasture, but many areas are idle. A large acreage is in scrub trees; only a very small acreage is in timber of commercial value. (Capability unit VIe–1; woodland suitability group 6)

Jessup silty clay loam, 12 to 20 percent slopes, severely eroded (JsD3).—This soil is on upper hillsides. The areas are narrow, and many are more than 100 acres in size. The soil has the profile described as representative for the series, except that most of the original surface soil has washed away. The present plow layer consists mostly of silty clay loam from the subsoil. Shallow gullies are common.

Included in mapping were small areas where the subsoil is gravelly sandy clay.

The hazard of erosion is too severe for this soil to be used for cultivated crops. Organic-matter content is very low. Gullies and the slope are limitations for the use of farm machinery. This soil can be used for pasture or hay. The hardier grasses and legumes, such as tall fescue and sericea lespedeza, are better suited to this soil than less hardy grasses and legumes.

The soil is used mostly for pasture. A few acres are idle. (Capability unit VIe–1; woodland suitability group 7)

Lakin Series

The Lakin series consists of deep, excessively drained, sandy soils that formed in sandy materials deposited by wind or water. These soils occur in hummocky areas on stream terraces and uplands along the Ohio River. Slope ranges from 0 to 12 percent.

In a representative profile, the uppermost 18 inches is dark-brown loamy fine sand. The subsoil, to a depth of 50 inches or more, is dark yellowish-brown or yellowish-brown, loose loamy fine sand. Thin bands of soil material, darker than the rest of this layer, occur below a depth of 34 inches.

The Lakin soils have a deep rooting zone and rapid permeability. They are strongly acid unless limed, and they are low in natural fertility. Available moisture capacity is low, and organic-matter content is low. These soils are easy to till.

Representative profile of Lakin loamy fine sand, 2 to 12 percent slopes:

Ap—0 to 7 inches, dark-brown (10YR 3/3) loamy fine sand; single grain; loose; medium acid; clear, smooth boundary.

A3—7 to 18 inches, dark-brown (10YR 4/3) loamy fine sand; single grain; loose; medium acid; gradual, smooth boundary.

B11—18 to 24 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; single grain; loose; medium acid; gradual, smooth boundary.

B12—24 to 34 inches, yellowish-brown (10YR 5/6) loamy fine sand; single grain; loose; strongly acid; clear, smooth boundary.

C&B2—34 to 50 inches +, yellowish-brown (10YR 5/4) loamy coarse sand and loamy fine sand; single grain; loose; dark yellowish-brown (10YR 4/4) bands ½- to 1-inch thick and lumps up to 1 inch in diameter that make up as much as 8 percent of the horizon; bands have 2 to 5 percent more clay than the interband layers; very friable; weak, granular structure; strongly acid.

The depth to rock is more than 10 feet. A few small white pebbles are scattered through the soil in places. The A and B horizons are strongly acid where unlimed. The A horizon is dark brown (10YR 3/3) and dark grayish brown (10YR 4/2); the texture is loamy fine sand to fine sand. The B horizon is yellowish brown (10YR 5/4-5/6), dark yellowish brown (10YR 4/4), and dark brown (7.5YR 4/4). The bands are dark yellowish brown (10YR 4/4 or 10YR 3/4 and dark brown (10YR 3/3). The texture of the bands ranges from sandy loam to fine sand.

These soils have an Ap horizon that is darker than the defined range for the Lakin series, but they do not differ in use and behavior from Lakin soils in other places.

The Lakin soils are much sandier than the Chavies and Wheeling soils that are nearby, and they show much less evidence of clay accumulation in the B horizon than either the Chavies or the Wheeling soils.

Lakin loamy fine sand, 0 to 2 percent slopes (LaA).—This soil is on Ohio River stream terraces in narrow areas 5 to 10 acres in size. It has the profile described as representative for the series, except that the darker colored bands are less prominent.

Included in mapping were soils that have few, if any, bands in their profile.

This soil is subject to occasional flooding, and it is droughty because of the sandy texture. Irrigation is needed during most growing seasons.

Cultivated crops and pasture or hay plants that are least affected by droughtiness are suited to this soil. Although most of the acreage is in grass or woods, some areas are used for corn and vegetables. (Capability unit IIIs–1; woodland suitability group 5)

Lakin loamy fine sand, 2 to 12 percent slopes (LaC).—This soil is in hummocky areas 5 to 50 acres in size. A profile of this soil is described as representative for the series.

The hazard of erosion is moderate, but this soil is droughty because of the sandy texture. Irrigation is needed during most growing seasons. Cultivated crops and pasture or hay plants that are least affected by droughtiness are suited to this soil. Although most of the soil is in grass or weeds, a large acreage is used for corn and early vegetables. (Capability unit IIIs–1; woodland suitability group 5)

Lawrence Series

The Lawrence series consists of deep, somewhat poorly drained soils that have a fragipan. These soils formed in mixed alluvium, chiefly of limestone origin. Most areas are nearly level and are on stream terraces along the Licking River.

In a representative profile, the surface layer is dark grayish-brown silt loam about 6 inches thick. The upper 6 inches of the subsoil consists of mottled, brown, friable silt loam. This is underlain by mottled, yellowish-brown, friable light silty clay loam 5 inches thick. At depths between 17 and 34 inches is a very firm, compact and brittle fragipan of mottled, pale-brown and gray silty clay loam. Below this is a fragipan of mottled silty clay loam that extends to a depth of 50 inches or more. The upper part is pale brown, and the lower part is strong brown.

The Lawrence soils are shallow above the fragipan, which slows water movement and restricts root growth. Available moisture capacity is moderate. The surface layer is strongly acid unless limed. Natural fertility is moderate, and the organic-matter content is low. These soils are easy to till, and they can be worked throughout a wide range of moisture content without forming clods.

Representative profile of Lawrence silt loam:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint, light brownish-gray (10YR 6/2) mot-

tles; weak, fine, granular structure; very friable; medium acid; gradual, wavy boundary.

B1—6 to 12 inches, brown (10YR 5/3) silt loam; common, fine, faint, yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) mottles; weak, fine and medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B2t—12 to 17 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles and few, fine, distinct, pale-yellow (2.5Y 7/4) mottles; moderate, medium, angular blocky structure; friable; few thin clay films; strongly acid; clear, smooth boundary.

Bx1—17 to 34 inches, pale-brown (10YR 6/3) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4 and 5/6) mottles and common, fine, faint, light brownish-gray (2.5Y 6/2) mottles; moderate, very coarse, prismatic structure parting to fine and medium angular blocky; very firm, compact and brittle; common patchy clay films on peds; very strongly acid; gradual, wavy boundary.

Bx2—34 to 50 inches +, strong-brown (7.5YR 5/8) silty clay loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) and light-gray (2.5Y 7/2) mottles; weak, coarse, prismatic structure parting to weak, medium, angular blocky; very firm, brittle and compact; few, fine, dark concretions; very strongly acid.

The solum is 3 to 5 feet thick, but depth to rock is more than 10 feet. The depth to the fragipan ranges from 14 to 18 inches. The Ap and B1 horizons are strongly acid where unlimed. The Ap horizon is dark grayish brown (2.5Y 4/2 and 10YR 4/2). The B1 and Bt horizons are brown (10YR 4/3), yellowish brown (10YR 5/4), and light yellowish brown (2.5Y 6/4).

The Lawrence soils occur with Captina and Robertsville soils. They are more poorly drained than Captina soils, as indicated by gray mottles higher in the B horizon. They are less grayish throughout the solum than the more poorly drained Robertsville soils.

Lawrence silt loam (0 to 4 percent slopes) (lc).—This soil is on stream terraces. It occupies narrow areas that range from 20 to 50 acres in size.

There is little or no hazard of erosion, but the soil becomes waterlogged above the slowly permeable fragipan in winter and spring. Also, water tends to collect on the flat areas. Where outlets are available, the surface water can be drained by open ditches.

This soil is suited to crops that can tolerate some seasonal wetness and limited available moisture in summer. Most of the acreage is used for pasture, but a small acreage is used for corn and hay. (Capability unit IIIw–1; woodland suitability group 3)

Licking Series

The Licking series consists of deep, moderately well drained soils that have a clayey subsoil. These soils formed in moderately fine textured and fine textured lacustrine material that contains thin strata of fine sand or silt. They occur on stream terraces along streams within a few miles of the Ohio River and in the central part of Campbell County. Slope ranges from 0 to 20 percent.

In a representative profile, the surface layer is dark yellowish-brown silt loam about 6 inches thick. The subsoil, about 29 inches thick, is yellowish-brown, friable to firm silty clay loam in the upper part and yellowish-brown, mottled, slightly sticky and plastic silty clay or clay in the lower part. Below the subsoil, to a depth of 50 inches or more, is light olive-brown clay mottled with light brownish gray.

The Licking soils have a moderately deep rooting zone and are slowly permeable. They are strongly acid in the surface layer unless limed, and they are moderate in natural fertility. Available moisture capacity is moderate.

Representative profile of Licking silt loam, 2 to 6 percent slopes:

Ap—0 to 6 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, very fine, granular structure; friable; neutral; clear, smooth boundary.

B1—6 to 10 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, fine and medium, subangular blocky structure; friable; dark yellowish-brown (10YR 4/4) silt coatings; strongly acid; clear, smooth boundary.

B21t—10 to 17 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; few clay films on peds; strongly acid; clear, smooth boundary.

IIB22t—17 to 25 inches, yellowish-brown (10YR 5/4) silty clay; few, fine, faint, yellowish-brown (10YR 5/8) and light olive-brown (2.5Y 5/4) mottles, and few, distinct, light-gray (10YR 7/2) mottles; moderate, medium, angular blocky structure; firm, slightly sticky and slightly plastic; common clay films; strongly acid; gradual, wavy boundary.

IIB3t—25 to 35 inches, yellowish-brown (10YR 5/6) clay; common, fine, distinct, light brownish-gray (10YR 6/2 or 2.5Y 6/2) mottles; moderate, medium, angular blocky structure; very firm, sticky and plastic; few clay films; strongly acid; gradual, wavy boundary.

IIC—35 to 50 inches +, light olive-brown (2.5Y 5/4) clay; common, medium, distinct, light brownish-gray (2.5Y 6/2) mottles; weak, thin, platy structure; very firm, sticky and plastic; few thin layers of iron concretionary material that is black, yellow, and red; concretions are 1/32 inch thick and platy; medium acid.

The solum ranges from 24 to 40 inches in thickness, but the depth to rock is more than 10 feet. Calcareous material is as near as 40 inches to the surface in some profiles, but it is lacking in others. In uneroded areas the texture of the A horizon is silt loam, but it ranges to silty clay in severely eroded areas. The B horizon is yellowish brown (10YR 5/4 or 10YR 5/6) and brown (10YR 5/3). The texture of the B21t horizon is silty clay loam or silty clay.

The Licking soils occur with the Captina soils. The lower part of their subsoil is clayey, as is the lower part of the subsoil of Brashear and Jessup soils. Licking soils lack the fragipan of Captina soils, and they are finer textured below the A horizon than those soils. Unlike the Brashear and Jessup soils, the Licking soils have gray mottles in the upper 10 inches of the Bt horizon.

Licking silt loam, 2 to 6 percent slopes (lkB).—This soil soil is on stream terraces in areas that are 10 to 40 acres in size. It has a profile described as representative for the series, except it has gray mottles nearer the surface.

There is no hazard of erosion. This soil is ponded in level or depressed areas during periods of heavy rainfall because of the slow surface runoff and slow permeability. Where outlets are available, the surface water can be drained by open ditches. Organic-matter content is low. Plants that can tolerate some seasonal wetness are suited to this soil.

Most of the acreage is used for pasture; a small acreage is used for corn and hay. (Capability unit IIIw–1; woodland suitability group 3)

Licking silt loam, 2 to 6 percent slopes (lkB).—This soil occurs on old stream terraces in areas about 5 to 30 acres in size. It has the profile described as representative for the series.

Included in mapping were some small areas of soils that are well drained and a few small areas that have a strong-brown subsoil.

The hazard of erosion is moderate if cultivated crops are grown. Organic-matter content is low. This soil is easy to till and can be worked throughout a wide range of moisture content without forming clods. Most cultivated crops and pasture or hay plants common in the survey area are suited to this soil.

This soil is used mostly for hay; a small acreage is used for corn. (Capability unit IIe–2); woodland suitability group 6)

Licking silty clay loam, 6 to 12 percent slopes (LlC).—This soil is on stream terraces in areas generally about 5 to 30 acres in size. It has the profile described as representative for the series, except that the plow layer is dominantly dark yellowish-brown silty clay loam.

Included in mapping are small areas that are dark grayish-brown silt loam in the upper 2 to 3 inches of the surface layer. Also included are some areas that are well drained.

This soil has a severe hazard of erosion if it is used for cultivated crops. The organic-matter content is low. This soil is more difficult to till than the silt loam phase because of its moderately fine texture. The surface crusts after showers. Most cultivated crops and pasture or hay plants common in the survey area are suited to this soil. The soil is used mostly for hay and pasture. (Capability unit IIIe–2; woodland suitability group 6)

Licking silty clay loam, 12 to 20 percent slopes (LlD).—This soil is on stream terraces in areas generally 10 to 100 acres in size. It has the profile described as representative for the series, except that the plow layer is brown and dark yellowish-brown silty clay loam.

Included in mapping are a few areas that have a silt loam surface layer. Also included are some areas that are well drained.

The erosion hazard is very severe if this soil is used for cultivated crops. Organic-matter content is low. The plow layer is difficult to till because of its moderately fine texture. The slope is a limitation for the use of farm machinery.

The soil is better suited to pasture or hay, but it can be used for cultivated crops that require little tillage. Most pasture and hay plants common in the survey area are suited to this soil. This soil is used mostly for pasture. A few acres are used for crops, and a few acres for trees. (Capability unit IVe–1; woodland suitability group 6)

Licking silty clay, 12 to 20 percent slopes, severely eroded (LmD3).—This soil is on old stream terraces in areas generally 10 to 100 acres in size. It has the profile described as representative for the series, except that most of the original surface soil and some of the subsoil has eroded away. The present plow layer is dominantly dark yellowish-brown silty clay. Shallow gullies are common in places.

Included in mapping are some areas that are well drained.

The hazard of erosion is too severe for the soil to be used for cultivated crops. The organic-matter content is very low. Gullies, in some places, and steepness of slope hinder the use of farm machinery.

Most pasture or hay plants common in the survey area are suited to this soil. It is used mostly for pasture, but some areas are idle. (Capability unit VIe–1; woodland suitability group 7)

Lindside Series

The Lindside series consists of deep, moderately well drained, loamy soils. These soils formed in recent alluvium chiefly of limestone origin. They are on flood plains along many of the streams in the survey area.

In a representative profile, the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is silt loam about 22 inches thick. It is dark grayish brown in the upper part and grayish brown and mottled in the lower 8 inches. Below this, to a depth of 50 inches or more, is mottled, light olive-brown and yellowish-brown silt loam.

The Lindside soils have a deep rooting zone, and they are moderately permeable. They are neutral to mildly alkaline throughout and are high in natural fertility. Available moisture capacity is high, and organic-matter content is medium. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Lindside silt loam:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; mildly alkaline; clear, smooth boundary.

B2—7 to 21 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.

B3—21 to 29 inches, grayish-brown (2.5Y 5/2) silt loam; many, fine, faint, light olive-brown (2.5Y 5/4) and yellowish-brown (10YR 5/4) mottles, and few, fine, faint, light brownish-gray (2.5Y 6/2) and dark grayish-brown (10YR 4/2) mottles; weak, medium, granular structure to massive; friable; few black specks of soft material from decayed roots; mildly alkaline; gradual, smooth boundary.

C1—29 to 40 inches, light olive-brown (2.5Y 5/4) silt loam; common, fine, distinct, light-gray (2.5Y 7/2) and yellowish-brown (10YR 5/6) mottles; massive but porous; friable; few, very soft, dark specks from decayed roots; neutral; gradual, smooth boundary.

C2—40 to 50 inches +, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) mottles and few, fine, faint, yellowish-brown (10YR 5/6) mottles that increase in number with depth; massive; friable; neutral.

In most places the depth to rock is more than 10 feet, and the depth to gray mottles is 20 to 24 inches. The hue of the Ap and B horizons is 10YR and 2.5Y. Reaction is mildly alkaline or neutral. These soils are more alkaline than the defined range for the Lindside series, but they do not differ in use or behavior from Lindside soils in other places.

The Lindside soils occur with the Newark, Nolin, and Huntington soils. They differ mostly in degree of natural drainage. Lindside soils are better drained and have less gray color than the Newark soils. They are less well drained and more grayish than Nolin and Huntington soils. Lindside soils have a lighter colored plow layer than Huntington soils.

Lindside silt loam (0 to 4 percent slopes) (Ln).—This soil is on flood plains in areas that are generally 3 to 10 acres in size.

The hazard of erosion is slight. Flooding is a limitation during winter and spring, but crops are seldom damaged during the summer growing season. This soil has a seasonal high water table at a depth of 1 to 2 feet during the wettest periods of winter and spring. Artificial drainage may be beneficial for some crops. All com-

monly grown cultivated crops and pasture or hay plants, except for winter small grain and alfalfa, are suited to this soil. Although most of this soil is in grass, a large acreage is used for corn, and a few acres are used for gardens. (Capability unit I–1; woodland suitability group 2)

Negley Series

The Negley series consists of deep, well-drained soils that have a loamy subsoil. The upper layers of these soils formed in 10 to 18 inches of loess; the lower layers formed in sandy alluvium or glacial outwash. Negley soils occur on narrow ridgetops and hillsides. Slope ranges from 2 to 20 percent.

In a representative profile, the plow layer is dark-brown silt loam about 5 inches thick. The subsoil extends to a depth of 63 inches or more. In sequence from the top, the upper 7 inches is yellowish-brown very friable silt loam, the next 4 inches is strong-brown, friable light silty clay loam, the next 12 inches is yellowish-brown friable loam, and the next 10 inches is yellowish-brown fine sandy loam, and the lower 25 inches is mottled strong-brown sandy clay loam.

The Negley soils have a deep rooting zone and are moderately permeable. They are very strongly acid in the surface layer, unless limed, and they are moderate in natural fertility. Available moisture capacity is high, but organic-matter content is low. These soils are easy to till, and they can be worked throughout a wide range of moisture content without forming clods.

Representative profile of Negley silt loam, 12 to 20 percent slopes:

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; very strongly acid; clear, smooth boundary.

B1—5 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure and weak, fine, subangular blocky; very friable; very strongly acid; gradual, smooth boundary.

B21t—12 to 16 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; few clay films; very strongly acid; clear, smooth boundary.

IIB22t—16 to 28 inches, yellowish-brown (10YR 5/6) heavy loam; weak, medium, subangular blocky structure; friable; few clay films; very strongly acid; abrupt, smooth boundary.

IIB23t—28 to 38 inches, yellowish-brown (10YR 5/6) to brownish-yellow (10YR 6/6) fine sandy loam; weak, fine, granular structure, or weak, fine, subangular blocky; compact in place, loose if disturbed; few clay films; very strongly acid; abrupt, wavy boundary.

IIB24t—38 to 63 inches +, strong-brown (7.5YR 5/6) sandy clay loam; common, fine, faint, yellowish-red (5YR 4/6) mottles; few, fine, distinct, light brownish-gray (2.5Y 6/2) and light yellowish-brown (2.5Y 6/4) mottles, and common, fine, faint, brownish-yellow (10YR 6/6) mottles; weak, fine, subangular blocky structure with clay bridging of sand grains; firm in place, but loose when disturbed; very strongly acid.

The solum ranges from 4 feet to more than 6 feet in thickness, and the depth to rock is more than 10 feet. The lower part of the B horizon ranges from 10YR to 5YR in hue and from 3 to 8 in chroma. The value is 4 or 5. The texture of the IIB horizon is sandy loam, loam, clay loam, or sandy clay loam. In some profiles the IIB horizon is gravelly.

The Negley soils occur on the same landscape with the Jessup, Faywood, Nicholson, and Rossmoyne soils. They are coarser textured throughout the B horizon than Jessup and Faywood soils and are deeper to bedrock than Faywood soils. Negley soils lack the fragipan that is characteristic of Nicholson and Rossmoyne soils, and they are better drained than those soils.

Negley silt loam, 2 to 6 percent slopes (NeB).—This soil is on ridgetops in areas generally about 5 to 20 acres in size.

Included in mapping were small areas that have a loam plow layer and small areas that have a weakly developed fragipan.

The hazard of erosion is moderate if this soil is used for cultivated crops. The soil is suited to all crops commonly grown in the survey area. It is used mostly for community development purposes. (Capability unit IIe–1; woodland suitability group 1)

Negley silt loam, 6 to 12 percent slopes (NeC).—This soil is on ridgetops in areas that are mainly 5 to 20 acres in size.

Included in mapping were some small areas that have a loam plow layer. Also included were small areas that have a yellowish-brown silt loam plow layer 4 to 5 inches thick.

The hazard of erosion is severe if this soil is used for cultivated crops.

All the commonly grown cultivated crops and pasture and hay plants are suited to this soil. Most of the acreage is used for hay and pasture, but a large acreage is used for parks and buildings. (Capability unit IIIe-1; woodland suitability group 1)

Negley silt loam, 12 to 20 percent slopes (NeD).—This soil is on upper hillsides in areas that are generally about 10 to 20 acres in size. A profile of this soil is described as representative for the series.

Included in mapping were small areas that have a loam plow layer.

This soil is better suited to pasture or hay than to row crops, but it can be cultivated occasionally. The hazard of erosion, however, is very severe in cultivated areas. Crops that require the least tillage help to reduce the erosion hazard. Most of the acreage is in second-growth trees, but some is used for pasture. (Capability unit IVe–1; woodland suitability group 1)

Newark Series

The Newark series consists of deep, somewhat poorly drained, loamy soils on flood plains along the major streams. These soils formed in recent alluvium, mostly of limestone origin. They are level to nearly level.

In a representative profile, the surface layer is dark grayish-brown silt loam about 7 inches thick. The upper part of the subsoil is dark grayish-brown friable silt loam 5 inches thick. Below this, to a depth of 50 inches or more, is light brownish-gray, mottled, friable silt loam underlain by gray, mottled, firm to friable light silty clay loam.

The Newark soils have a deep rooting zone that is moderately permeable. The soils are neutral to mildly alkaline throughout the profile, and they are moderately high in natural fertility. Available moisture capacity is high, and organic-matter content is low. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Newark silt loam:

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, fine, granular structure; friable; mildly alkaline; clear, smooth boundary.

B21—7 to 12 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, fine, granular structure; friable; mildly alkaline; clear, smooth boundary.

B22g—12 to 24 inches, light brownish-gray (2.5Y 6/2) silt loam; common, fine, faint, grayish-brown (2.5Y 5/2) mottles; few, fine, distinct, yellowish-brown (10YR 5/8) mottles and common, fine, faint, yellowish-brown (10YR 5/4) mottles; weak, very fine, subangular blocky and granular structure; friable; mildly alkaline; gradual, wavy boundary.

C1g—24 to 36 inches, light brownish-gray (2.5Y 6/2) silt loam; common, fine, distinct, yellowish-brown (10YR 5/4) and dark-brown (7.5YR 4/4) mottles; massive; friable; few, very fine, dark concretions; neutral; gradual, wavy boundary.

C2g—36 to 46 inches, gray (10YR 6/1) light silty clay loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; massive; firm; few dark concretions; mildly alkaline; clear, smooth boundary.

C3g—46 to 50 inches +, mottled, light brownish-gray (2.5Y 6/2), gray (N 5/0), strong-brown (7.5YR 5/8), yellowish-brown (10YR 5/4), very dark grayish-brown (10YR 3/2), and pale-brown (10YR 6/3) light silty clay loam; massive; friable; mildly alkaline.

The depth to rock is generally more than 10 feet. Reaction ranges from neutral to mildly alkaline throughout the profile. The colors of the Ap and B horizon are in hues of 2.5Y and 10YR. The texture of all horizons is silt loam or silty clay loam.

The Newark soils are more poorly drained and grayer in color below the A horizon than the Lindside, Huntington, Nolin, and Egam soils that occur with them. Newark soils have a lighter colored A horizon than Huntington soils, and they are lighter in color and coarser textured throughout than Egam soils.

Newark silt loam (0 to 4 percent slopes) (Nk).—This soil is in low areas on flood plains. The areas are generally 5 to 40 acres in size.

Included in mapping were small areas of poorly drained soils and a small acreage of a soil that is 27 to 40 percent clay at a depth of 10 to 30 inches.

Erosion is not a problem on this soil; however, unless the soil is drained artificially, a seasonal high water table rises to within ½ to 1½ feet of the surface during rainy seasons and delays planting of spring crops. The soil is subject to occasional flooding during winter and spring. If drained, this soil is suited to most cultivated crops common in the survey area except winter small grains. Pasture or hay plants that tolerate some wetness are better suited. The soil is used mostly for hay and pasture, but a small acreage is used for tobacco, corn, and gardens. (Capability unit IIw–1; woodland suitability group 3)

Nicholson Series

The Nicholson series consists of deep, well drained to moderately well drained soils that have a fragipan. The upper layers of these soils formed in a layer of loess 30 to 48 inches thick; the lower layers formed in residual material that weathered from interbedded limestone and calcareous shale. The soils are on broad upland ridges. Slope ranges from 0 to 12 percent.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 26 inches, is dark-brown friable silt loam in the upper part and yellowish-brown friable silty clay loam in the lower part. A firm, brittle and compact silty clay loam fragipan, about 10 inches thick, is below this. Underlying this fragipan, to a depth of 50 inches or more, is a layer of sticky and plastic silty clay that is mottled in shades of gray and brown in the upper part and is dominantly yellowish brown in the lower part.

The Nicholson soils are moderately deep to the fragipan, which slows water movement and restricts root growth. These soils are strongly acid in the upper layers unless limed, and they are moderate in natural fertility. Available moisture capacity is moderate, and the soils are easy to till. They can be worked throughout a wide range of moisture content without clodding.

Representative profile of Nicholson silt loam, 0 to 6 percent slopes:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak to moderate, fine, granular structure; very friable; neutral; clear, smooth boundary.

B1—8 to 13 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

B2t—13 to 26 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; few clay films; strongly acid; gradual, smooth boundary.

Bx1—26 to 30 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, faint, light brownish-gray (10YR 6/2), pale-brown (10YR 6/3), yellowish-brown (10YR 5/8), and light olive-brown (2.5Y 5/4) mottles; weak to moderate, very coarse, prismatic structure parting to weak, medium, subangular blocky; firm, brittle and compact; strongly acid; clear, smooth boundary.

Bx2—30 to 36 inches, dark-brown (7.5YR 4/4) silty clay loam; common, fine, faint, strong-brown (7.5YR 5/6) mottles and common, medium, distinct, light brownish-gray (2.5Y 6/2) mottles; moderate, very coarse, prismatic structure parting to weak, medium, subangular blocky; very firm, brittle and compact; strongly acid; gradual, wavy boundary.

IIB3t—36 to 46 inches, silty clay that contains light brownish-gray (2.5Y 6/2), light yellowish-brown (2.5Y 6/4), yellowish-brown (10YR 5/6), and brownish-yellow (10YR 6/6) mottles; weak, medium, blocky structure; firm, sticky and plastic; common, small, dark concretions; medium acid; gradual, wavy boundary.

IIC—46 to 50 inches +, yellowish-brown (10YR 5/6) and light brownish-gray (2.5Y 6/2) silty clay; weak, thin, platy structure; firm, sticky and plastic; slightly acid.

The solum is 40 to 60 inches thick, and the depth to rock ranges from 5 to more than 8 feet. The depth to the fragipan ranges from 20 to 30 inches. The Ap and B1 horizons are strongly acid where unlimed. The Ap horizon is dark grayish brown (10YR 4/2) and dark brown (10YR 4/3). Some profiles have a dark-brown (10YR 3/3) A1 horizon that is less than 6 inches thick. The A horizon is dominantly silt loam but is silty clay loam in severely eroded areas. The B horizon is in hues of 10YR and 7.5YR. The texture of the B2t horizon is silt loam or silty clay loam.

The Nicholson soils occur with the Faywood, Eden, and Rossmoyne soils. They have a thicker solum and a coarser textured B horizon than Faywood and Eden soils. Faywood and Eden soils also lack the fragipan that is characteristic of the Nicholson soils. Nicholson soils differ from Rossmoyne soils in that they are generally deeper to gray mottles, are shallower to bedrock, and are underlain by limestone and shale instead of glacial till.

Nicholson silt loam, 0 to 6 percent slopes (NlB).—This soil is on ridgetops. The areas are not broad, but many are several hundred acres in size because they fol-

low the ridgetops for several miles. A profile of this soil is described as representative for the series.

Included in mapping were small areas that have a plow layer 4 to 6 inches thick and a fragipan at a depth of about 18 inches.

The hazard of erosion is moderate if cultivated crops are grown. Organic-matter content is medium. Permeability is slow in the fragipan.

All cultivated crops and most pasture and hay plants common in this survey area are suited to this soil. The soil is used mostly for hay and pasture, but a large acreage is used for tobacco, gardens, and such nonfarm purposes as community development. (Capability unit IIe-3; woodland suitability group 4)

Nicholson silt loam, 6 to 12 percent slopes (NIC).—This soil is on ridgetops in narrow areas; many are several hundred acres in size. It has the profile described as representative for the series, except that the plow layer is a mixture of topsoil and subsoil 3 to 6 inches thick.

Included in mapping are small areas that have a dark grayish-brown silt loam surface layer, areas where most of the original surface soil has been removed by erosion, and also a few seepy spots and eroded areas where the fragipan is nearer the surface.

The hazard of erosion is severe if cultivated crops are grown. Organic-matter content is low. Permeability is slow in the fragipan.

Most of the cultivated crops and pasture or hay plants common in the survey area are suited to this soil. The soil is used mostly for hay and pasture, but a small acreage is used for tobacco and corn. (Capability unit IIIe-3; woodland suitability group 4)

Nolin Series

The Nolin series consists of deep, well-drained, loamy soils that formed in recent alluvium mostly of limestone and calcareous shale origin. These are nearly level soils on the flood plains along all the streams in the survey area except the Ohio River.

In a representative profile, the surface layer is dark grayish-brown silt loam, about 9 inches thick. The subsoil consists of 21 inches of olive-brown, friable silt loam and 20 inches or more of dark-brown, friable silt loam.

The Nolin soils have a deep rooting zone, and they are moderately permeable. They are slightly acid to neutral in reaction. Natural fertility is high. Available moisture capacity is high, and organic-matter content is medium. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Nolin silt loam:

Ap—0 to 9 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, fine and medium, granular structure; very friable; neutral; clear, smooth boundary.

B21—9 to 30 inches, olive-brown (2.5Y 4/4) silt loam; weak, fine, granular structure; friable; neutral; gradual, wavy boundary.

B22—30 to 50 inches +, dark-brown (10YR 4/3) heavy silt loam; weak, fine, granular structure to massive; friable; neutral.

The depth to rock is generally more than 10 feet. Reaction is slightly acid to neutral. In places the Ap horizon is dark grayish brown (10YR 4/2), and the B horizon is dark grayish brown (10YR 4/2) or dark yellowish brown (10YR 4/4).

The Nolin soils occur with the Lindside, Egam, and Ashton soils. They are free of gray mottles to a greater depth than Lindside soils. Nolin soils have a lighter colored plow layer and are coarser textured throughout than Egam soils. Unlike the Ashton soils, they have a lighter colored plow layer and lack clay films in the subsoil.

Nolin silt loam (0 to 4 percent slopes) (No).—This soil is on flood plains in narrow areas that range from 5 to 50 acres in size.

Included in mapping are some areas where the slope is more than 4 percent. Also included were some areas that are moderately alkaline throughout the profile.

The hazard of erosion is slight, and all crops that are grown in this survey area are suited to this soil. The soil is subject to flooding in winter and spring, but flooding seldom occurs during the growing season. Although most of this soil is in grass, a large acreage is used for corn, a few areas are idle, and a few are used for gardens. (Capability unit I-1; woodland suitability group 2)

Robertsville Series

The Robertsville series consists of deep, nearly level, poorly drained soils that have a fragipan. These soils formed in mixed alluvium dominantly of limestone origin. They are on stream terraces, mostly along the Licking River.

In a representative profile, the surface layer is very dark grayish-brown and grayish-brown silt loam about 6 inches thick. The subsoil, to a depth of about 13 inches, is mottled light-gray silt loam. Below this is a fragipan of firm, brittle and compact silty clay loam that extends to a depth of about 36 inches. The upper part of the fragipan is mottled, and the lower part is mostly light gray with some mottles. Underlying the fragipan, to a depth of 50 inches or more, is yellowish-brown, mottled, friable silty clay loam.

The Robertsville soils are shallow to a fragipan that slows water movement and restricts root growth. They are strongly acid to very strongly acid unless limed, and they are low in natural fertility. Available moisture capacity is low, and organic-matter content is low. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Robertsville silt loam:

A1—0 to 1 inch, very dark grayish-brown (10YR 3/2) silt loam; moderate, very fine, granular structure; very friable; strongly acid; clear, wavy boundary.

A2g—1 inch to 6 inches, grayish-brown (2.5Y 5/2) silt loam; weak, fine, granular structure; friable; strongly acid; clear, smooth boundary.

Bg—6 to 13 inches, light-gray (2.5Y 7/2) silt loam; common, fine, faint, light brownish-gray (2.5Y 6/2) mottles and common, fine, distinct, yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) mottles; weak, medium, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

Bx1—13 to 24 inches, mottled light brownish-gray (2.5Y 6/2), light-gray (2.5Y 7/2), pale-yellow (2.5Y 7/4), and yellowish-brown (10YR 5/8) light silty clay loam; moderate, very coarse, prismatic structure parting to weak, medium, blocky; firm, brittle and compact; common clay films; very strongly acid; gradual, wavy boundary.

Bx2—24 to 36 inches, light-gray (2.5Y 7/2) light silty clay loam; few, fine, faint, light brownish-gray (2.5Y 6/2) mottles, common, medium, distinct, yellowish-brown (10YR 5/8) mottles, and few, fine, distinct, dark-

brown (7.5YR 4/4) mottles; weak, coarse, blocky structure; firm, brittle and compact; few clay films; very strongly acid; gradual, wavy boundary.

C—36 to 50 inches +, yellowish-brown (10YR 5/6) light silty clay loam; common, medium, distinct light-gray (10YR 6/1) mottles and common, fine, faint, yellowish-brown (10YR 5/4) mottles; massive; friable; few very small dark concretions; very strongly acid.

The solum ranges from 32 to 48 inches in thickness, the depth to rock is more than 10 feet, and depth to the fragipan ranges from 12 to 16 inches. The A1 horizon described in the profile occurs only in wooded areas. The A horizon is in hues of 10YR and 2.5Y. The texture of the Bx horizon is silt loam or silty clay loam.

The Robertsville soils are more poorly drained and have a higher proportion of gray colors in the subsoil than the Lawrence soils that are nearby.

Robertsville silt loam (0 to 2 percent slopes) (Ro).—This soil is on stream terraces in areas that are generally 20 to 50 acres in size.

Included in mapping are small areas that are clayey in the lower part of the B horizon. Some included areas also lack a fragipan.

The hazard of erosion on this soil is slight, but the soil becomes waterlogged above the slowly permeable fragipan in winter and spring. At times, water collects on the flat areas. The fragipan and the lack of suitable outlets make this soil difficult to drain. Cultivated crops and pasture or hay plants that can tolerate seasonal wetness are suited to this soil. The soil is used mostly for pasture and hay. (Capability unit IVw-1; woodland suitability group 3)

Rossmoyne Series

The Rossmoyne series consists of deep, moderately well drained soils that have a fragipan. The upper layers of these soils formed in loess, and the lower layers formed in loamy and clayey calcareous glacial till. The soils occur mostly on broad glaciated ridges in the northeastern part of Boone County and the northwestern part of Kenton County. Slope ranges from 0 to 12 percent.

In a representative profile, the surface layer is dark-brown silt loam about 7 inches thick. The uppermost part of the subsoil consists of 4 inches of friable dark-brown silt loam that overlies 10 inches of yellowish-brown, firm silty clay loam that contains mottles in the lower part. A mottled, firm, brittle and compact, loamy fragipan, about 31 inches thick, is below a depth of 21 inches. Underlying the fragipan, to a depth of 60 inches or more, is mottled silty clay.

The Rossmoyne soils are moderately deep to a fragipan that slows water movement and restricts root growth. The soils are strongly acid in the surface layer unless limed, and they are moderate in natural fertility. Available moisture capacity is moderate, and the organic-matter content is low. The soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Rossmoyne silt loam, 0 to 6 percent slopes:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; medium acid; abrupt, smooth boundary.

B1t—7 to 11 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; few clay films; medium acid; gradual, smooth boundary.

B21t—11 to 17 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; firm; common clay films; strongly acid; clear, smooth boundary.

B22t—17 to 21 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm; few clay films on some ped surfaces; grayish-brown (10YR 5/2) silt coats on about 5 percent of ped surfaces; strongly acid; abrupt, wavy boundary.

Bx1—21 to 34 inches, mixed yellowish-brown (10YR 5/6) and dark-brown (7.5YR 4/4) light silty clay loam; light brownish-gray (10YR 6/2) and gray (10YR 5/1) silt coatings up to 1 millimeter thick on most ped surfaces; moderate, very coarse; prismatic structure parting to medium and fine prisms in the upper part; firm, compact and brittle; few dark concretions; very strongly acid; gradual, smooth boundary.

IIBx2—34 to 52 inches, dark-brown (7.5YR 4/4) clay loam or silty clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, fine and yellowish-brown (10YR 5/6) mottles; weak, fine and medium, angular blocky structure; few clay films; firm, brittle and compact; few (1 percent) small pebbles 1 to 3 millimeters in size; few patches of black concretionary material; very strongly acid; gradual, smooth boundary.

IIC—52 to 60 inches +, mottled, grayish-brown (10YR 5/2), yellowish-brown (10YR 5/4), yellowish-red (10YR 4/6), and pale-brown (10YR 6/3) silty clay that contains small pieces of weathered chert; massive; firm; neutral in upper part becoming mildly alkaline with depth.

The solum ranges from 44 to 60 inches in thickness. In most places the depth to rock is more than 10 feet. The depth to the fragipan ranges from 18 to 22 inches. The Ap and B1 horizons are strongly acid where unlimed. The Ap horizon is dark brown (10YR 4/3) or dark grayish brown (10YR 4/2). The B horizon is in hues of 10YR and 7.5YR. The texture of the IIB horizon is clay loam or light silty clay loam. The texture of the C horizon is silty clay or clay.

Rossmoyne soils occur with Avonburg, Nicholson, and Jessup soils. They are better drained and deeper to gray mottling than Avonburg soils. They are generally less well drained than Nicholson and Jessup soils and are generally deeper to bedrock than Nicholson soils because they are underlain by glacial till instead of limestone and shale.

Rossmoyne silt loam, 0 to 6 percent slopes (RsB).—This soil is on broad ridgetops; many areas are more than 100 acres in size. It has the profile described as representative for the series.

Included in mapping were areas on Ohio River terraces, where the underlying material is alluvium, rather than glacial till.

The hazard of erosion is moderate if cultivated crops are grown. Permeability is slow in the fragipan.

Most of the cultivated crops and pasture or hay plants commonly grown in the survey area are suited to this soil. The soil is used mostly for hay and pasture, but a large acreage is used for tobacco and corn. (Capability unit IIe-3; woodland suitability group 4)

Rossmoyne silt loam, 6 to 12 percent slopes (RsC).—This soil is mostly in areas that border the edge of gently sloping Rossmoyne soils. Areas of the soil are narrow but long enough to be more than 100 acres in size in many places. The soil has the profile described as representative for the series, except that the surface layer is thinner and, where tilled, the plow layer consists of the original surface layer and part of the subsoil.

Included in mapping were areas that have a weakly

developed fragipan and some areas along the Ohio River that are underlain by alluvium instead of glacial till.

The hazard of erosion is severe if cultivated crops are grown on this soil. Permeability is slow in the fragipan. Most of the cultivated crops and pasture and hay plants grown in the survey area are suited to this soil. The soil is used mostly for hay and pasture. (Capability unit IIIe-3; woodland suitability group 4)

Urban Land

Urban land (Ur) is made up of areas of soils that have been so disturbed by deep cutting and filling with earth-moving machinery that the original soil could not be determined. The areas are mostly in downtown Ludlow, Covington, Newport, and Dayton. They are underlain by deep, stratified alluvium deposited by the Licking and Ohio Rivers and by glacial outwash. The material ranges from slack-water clay to sand and gravel.

Many small areas of soils along roads and around buildings have properties similar to those of this land type. These areas are commonly included in mapping. A large gravel pit along the Ohio River near Belleview was also included. (Not in a capability unit; woodland suitability group 8)

Wheeling Series

The Wheeling series consists of deep, well-drained soils that have a loamy subsoil. These soils formed in alluvium of mixed origin, and they are underlain at a depth of 3½ to 6 feet by sand and gravel. They occur on stream terraces along the Ohio River. Slope ranges from 0 to 12 percent.

In a representative profile, the plow layer is dark grayish-brown silt loam about 7 inches thick. The subsoil extends to a depth of 50 inches or more and is mostly dark brown and friable. The texture is silt loam in the upper 6 inches and light silty clay loam in the next 31 inches. The lower 6 inches of the subsoil is yellowish-brown friable silt loam.

The Wheeling soils have a deep rooting zone, and they are moderately permeable. These soils are strongly acid throughout unless limed. They are moderately high in natural fertility. Available moisture capacity is high, and organic-matter content is medium. These soils are easy to till, and they can be worked throughout a wide range of moisture content without clodding.

Representative profile of Wheeling silt loam, 0 to 2 percent slopes:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very fine and fine, granular structure; friable; medium acid; clear, smooth boundary.

B1—7 to 13 inches, dark-brown (7.5YR 4/4) heavy silt loam; weak, fine, granular structure and weak, medium, subangular blocky; friable; strongly acid; clear, smooth boundary.

B21t—13 to 26 inches, dark-brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; friable; thin continuous clay films on peds; strongly acid; gradual, smooth boundary.

B22t—26 to 44 inches, dark-brown (7.5YR 4/4) light silty clay loam; common, fine, faint, brown (7.5YR 5/4) mottles; moderate, medium, subangular blocky structure; friable; few clay films; few, fine, dark concretions; strongly acid; clear, smooth boundary.

B3—44 to 50 inches +, yellowish-brown (10YR 5/6) silt loam; few, fine, faint mottles of strong brown (7.5YR 5/6), yellowish brown (10YR 5/8), and light yellowish brown (10YR 6/4); weak, fine and medium, subangular blocky structure; friable; strongly acid.

The solum ranges from 40 to 60 inches in thickness; depth to rock is more than 10 feet. The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3), and the texture is silt loam or loam. It is strongly acid where unlimed. The B horizon is in hues of 7.5YR or 10YR. The B3 horizon texture is silt loam, fine sandy loam, or fine sand. In some areas this horizon is gravelly.

The Wheeling soils occur with the Ashton, Licking, Rossmoyne, and Captina soils. They are more acid throughout and have a lighter colored plow layer than Ashton soils. Wheeling soils are better drained and have a coarser textured subsoil than Licking soils. They are better drained and lack the fragipan of Rossmoyne and Captina soils.

Wheeling silt loam, 0 to 2 percent slopes (WhA).—This soil is on stream terraces along the Ohio River in areas that range from 5 to 20 acres in size. A profile of this soil is described as representative for the series.

The hazard of erosion on this soil is slight, and all of the cultivated crops and pasture and hay plants commonly grown in this survey area are well suited to this soil.

The soil is used mostly for landscape nurseries, corn, vegetables, and fruit trees. Some areas are used for pasture and hay. (Capability unit I-2; woodland suitability group 1)

Wheeling silt loam, 2 to 6 percent slopes (WhB).—This soil is on stream terraces along the Ohio River in areas that range from 15 to 50 acres in size.

Included in mapping were small areas where the plow layer is less gray than that of the representative profile. Also included were small areas of soils that have gravelly and sandy material at a depth of 20 to 40 inches.

The hazard of erosion is moderate if this soil is used for cultivated crops. All of the cultivated crops and pasture and hay plants that are commonly grown in this survey area are suited to this soil. This soil is mostly used for landscape nurseries, vegetables, and fruit trees. Some areas are used for hay or pasture. (Capability unit IIe-1; woodland suitability group 1)

Wheeling silt loam, 6 to 12 percent slopes (WhC).—This soil is on stream terraces along the Ohio River in narrow areas that are generally 10 to 30 acres in size. It has the profile described as representative for the series, except that the plow layer is thinner and is a mixture of dark grayish brown and dark brown.

The hazard of erosion is severe if this soil is used for cultivated crops. All of the cultivated crops and pasture and hay plants that are commonly grown in this survey area are suited to this soil.

The soil is used mostly for hay with an occasional crop of corn. A small acreage is used for fruit and vegetables. (Capability unit IIIe-1; woodland suitability group 1)

Woolper Series

The Woolper series consists of deep, well-drained soils that have a clayey subsoil. These soils formed in colluvium or local alluvium washed mostly from Cynthiana soils. They are on foot slopes or alluvial fans at the base of steep hills. The slope ranges from 6 to 20 percent.

In a representative profile, the surface layer is very

dark grayish-brown silty clay loam about 8 inches thick. The subsoil, which extends to a depth of about 48 inches, is very dark grayish brown mottled with dark yellowish brown. It is sticky and plastic and has a clayey texture. Below the subsoil, to a depth of 60 inches or more, is yellowish-brown very sticky and plastic clay.

The rooting zone is deep. The surface layer is medium acid to mildly alkaline. Permeability is moderately slow, and available moisture capacity is high. Organic-matter content is high, and natural fertility is moderately high.

Representative profile of Woolper silty clay loam, 12 to 20 percent slopes:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay loam; moderate, fine, subangular blocky structure parting to moderate, fine, granular; friable, slightly sticky; many roots; medium acid; clear, smooth boundary.

B21t—8 to 33 inches, very dark grayish-brown (10YR 3/2) silty clay; common, medium, faint, dark yellowish-brown (10YR 4/4) mottles in lower third of horizon; moderate, fine and medium, angular blocky structure; very firm, sticky and plastic; common clay films; neutral; diffuse, smooth boundary.

B22t—33 to 48 inches, mottled very dark grayish-brown (10YR 3/2) and dark yellowish-brown (10YR 4/4) clay; weak, fine and medium, angular blocky structure; very firm, very sticky and plastic; few roots; common clay films; mildly alkaline; clear, smooth boundary.

C—48 to 60 inches +, yellowish-brown (10YR 5/6) clay; common, medium, distinct mottles of dark yellowish brown (10YR 4/4), strong brown (7.5YR 5/6), and light brownish gray (2.5Y 6/2); weak, coarse, angular blocky structure; very firm, very sticky and plastic; 15 percent strong-brown and dark-brown soft segregations containing iron; 5 percent weathered siltstone fragments; mildly alkaline.

The solum ranges from 36 to 50 inches in thickness. The depth to rock ranges from 3 feet to more than 10 feet. A few flagstones and pebbles occur in the profile and on the surface. The texture of the Ap horizon in uneroded areas is silty clay loam, and in eroded areas it ranges to silty clay. The B horizon is olive brown (2.5YR 4/4) or yellowish brown (10YR 5/4) at a depth below 18 inches in some profiles. The texture of the B horizon is silty clay or clay.

The Woolper soils occur with the Cynthiana, Egam, Ashton, and Brashear soils. They are deeper to bedrock and darker colored than Cynthiana soils. Woolper soils have a greater clay accumulation in the subsoil than Egam soils and are on foot slopes and alluvial fans above the flood plains. Woolper soils are finer textured throughout than Ashton soils. They are darker colored in the upper part of the solum than Brashear soils and lack gray mottles to a greater depth.

Woolper silty clay loam, 6 to 12 percent slopes (WoC).—This soil is on alluvial fans or foot slopes. Areas are 3 to 10 acres in size.

Included in mapping were a few areas that have a lighter colored subsoil at a depth below about 15 inches.

The hazard of erosion is severe if this soil is used for cultivated crops. The plow layer is difficult to till because of its moderately fine texture. The soil is well suited to hay, pasture, and all the commonly grown crops. It is used mostly for hay and pasture, but a moderate acreage is used for tobacco and corn. (Capability unit IIIe–2; woodland suitability group 6)

Woolper silty clay loam, 12 to 20 percent slopes (WoD).—This soil is on foot slopes below steeper areas of Cynthiana soils. Most areas are 3 to 15 acres in size. The soil has the profile described as representative for the series.

Included in mapping were some areas that are lighter colored in the upper part of the subsoil.

The hazard of erosion is very severe if this soil is used for cultivated crops; the soil is suited to occasional cultivation, however. The plow layer is difficult to till because of the moderately fine texture. The soil is suited to most of the commonly grown cultivated crops and is well suited to pasture and hay plants.

A large acreage is used for pasture, but much of this soil is in second-growth trees. (Capability unit IVe–1; woodland suitability group 6)

Use and Management of the Soils

This section contains information about the use and management of the soils of Boone, Campbell, and Kenton Counties for crops and pasture, for woodland, for wildlife, for engineering purposes, and for town and country planning. It explains the system of capability classification used by the Soil Conservation Service and gives estimated yields of the principal crops grown in the area under two levels of management.

Use of the Soils for Crops and Pasture[2]

Some principles of management are general enough to apply to the soils on all farms in the survey area, though the individual soils or groups of soils require different kinds and degrees of management. These general principles of management are discussed in the following paragraphs.

On many soils in the survey area, the addition of lime, fertilizer, or both, is needed. The amounts needed depend on the natural content of lime and the natural fertility level, on past cropping and management, on the needs of the crop, and on the level of yield desired. Specific statements cannot be made concerning the use of lime and fertilizer, and suggestions in this survey should be accepted only in a general sense.

Most of the soils of Boone, Campbell, and Kenton Counties are naturally low in organic-matter content, and building up this content is not economical. It is important, however, to maintain the supply of organic matter by adding farm manure, by leaving plant residue on the surface, and by using other practices that promote extensive root systems and vigorous growth.

Tillage is needed to prepare a seedbed and to control weeds, but it should be kept to a minimum because it generally tends to break down the structure of the soil. Adding organic matter and growing sod crops, cover crops, and green-manure crops are helpful in preventing breakdown of soil structure.

All of the sloping cultivated soils in the survey area are susceptible to erosion and to loss of organic matter and plant nutrients from the surface layer. Because most erosion occurs when the cultivated crop is growing, or soon after the crop has been harvested, a cropping sequence should be selected that keeps the loss of soil and water to a minimum. This cropping sequence is most ef-

[2] WALTER J. GUERNSEY, conservation agronomist, Soil Conservation Service, helped write this section.

fective if it is used with one or more other practices of erosion control. These practices are contour farming, terracing, stripcropping, constructing diversions, grassing of waterways, using minimum tillage, using crop residue effectively, seeding cover crops, and applying fertilizer and lime if needed.

On most wet soils in the survey area, yields of cultivated crops can be increased by removing excess water through open ditches or tile drains. Tile drains are more expensive to install, but they generally provide better drainage than open ditches. Soils that have a fragipan are difficult to drain, but they can be drained better by open ditches than by tile. Open ditches are most effective if they intercept the water as it moves horizontally on top of the pan. For drainage by either tile or open ditches, suitable outlets are required.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when they are used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or engineering uses.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These levels are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (There are no class VIII soils in the survey area.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Boone, Campbell, and Kenton Counties are described, and suggestions for the use and management of the soils are given.

CAPABILITY UNIT I-1

This unit consists of nearly level, well drained soils of the Huntington and Nolin series and moderately well drained soils of the Lindside series. These soils are on flood plains.

These soils have a deep rooting zone, and they are high in natural fertility. The available moisture capacity is high, and permeability is moderate. Reaction is slightly acid to mildly alkaline.

The soils in this unit are suited to growing corn or tobacco year after year. Small grain and alfalfa are subject to damage from flooding in some areas. Some pasture and hay plants that grow well on these soils are Kentucky bluegrass, smooth brome, Kentucky 31 tall fescue, orchardgrass, Ladino clover, and Korean lespedeza.

These soils are easy to till. The general principles of management that apply to fertilization, maintenance of organic-matter content, and tillage practices are impor-

tant in keeping them productive. There is no erosion hazard, but these soils are subject to occasional flooding in winter. Wetness is a slight limitation to growing some crops on Lindside soils.

CAPABILITY UNIT I–2

This unit consists of nearly level, well-drained soils of the Ashton and Wheeling series. These soils are on stream terraces.

These soils have a deep rooting zone. The available moisture capacity is high, and permeability is moderate. Ashton soils are slightly acid to neutral; Wheeling soils are strongly acid unless limed. There is no hazard of erosion, and crops are seldom affected by flooding.

The soils in this unit are suited to corn, tobacco, and small grain year after year. Some of the pasture and hay plants that grow well on these soils are Kentucky bluegrass, smooth brome, Kentucky 31 tall fescue, orchardgrass, alfalfa, Ladino clover, and Korean lespedeza.

General principles of management that apply to fertilization, maintenance of organic-matter content, and tillage practices are important in keeping these soils productive.

CAPABILITY UNIT IIe–1

This unit consists of nearly level to gently sloping, well-drained, loamy soils of the Ashton, Chavies, Negley, and Wheeling series. The soils occupy stream terraces and upland areas.

These soils have a deep rooting zone, high available moisture capacity, and moderate to moderately rapid permeability. Except for the Ashton soil, which ranges from slightly acid to neutral, the soils in this unit are strongly acid or very strongly acid unless limed. The major limitation to farming these soils is a moderate hazard of erosion when the soils are cultivated.

The soils in this unit are well suited to corn, tobacco, and small grain. Some of the pasture and hay plants that grow well are Kentucky bluegrass, Kentucky 31 tall fescue, smooth bromegrass, orchardgrass, red clover, alfalfa, Korean lespedeza, and Ladino clover. Truck crops, orchards, vineyards, and nursery stock are also suited to the soils in this unit.

A combination of a cropping system and erosion control practices helps to slow surface runoff and reduce soil loss caused by erosion.

CAPABILITY UNIT IIe–2

This unit consists of gently sloping, well-drained or moderately well drained soils of the Faywood, Jessup, and Licking series. The soils have a loamy plow layer and clayey lower subsoil. They are on stream terraces and uplands.

These soils have a moderately deep to deep rooting zone, a moderate to high available moisture capacity, and moderately slow to slow permeability. They are strongly acid to slightly acid or neutral. The major limitation to use is a moderate hazard of erosion when cultivated crops are grown.

Crops common in the survey area, such as corn, tobacco, and small grain are suited to the soils in this unit. Some of the pasture and hay plants that grow well are Kentucky bluegrass, Kentucky 31 tall fescue, smooth bromegrass, orchardgrass, timothy, red clover, alfalfa, Ladino clover, sericea lespedeza, and Korean lespedeza.

When these soils are cultivated, a combination of a cropping system and eroison control practices helps to slow surface runoff and reduce soil loss caused by erosion.

CAPABILITY UNIT IIe–3

This unit consists of nearly level to gently sloping, moderately well drained soils of the Captina, Nicholson, and Rossmoyne series. These soils occupy stream terraces and upland areas. They have a fragipan at a depth of about 18 to 26 inches.

These soils have a moderately deep rooting zone over the fragipan, and they have moderate available moisture capacity. Permeability is moderate above the fragipan, but is slow through the fragipan. These soils are strongly acid where unlimed. The major limitation to use is a moderate hazard of erosion when the soils are cultivated.

Crops common in the survey area, such as corn, tobacco, and small grain, are suited to the soils of this unit. Some of the pasture and hay plants that are suited are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, red clover, Ladino clover, white clover, sericea lespedeza, and Korean lespedeza. Alfalfa will generally die out in 2 to 4 years on these soils because of restricted rooting depth and a seasonal high water table that forms over the fragipan during periods of heavy rainfall.

A combination of a cropping system and erosion control practices helps to slow surface runoff and reduce soil loss caused by erosion.

CAPABILITY UNIT IIw–1

This unit consists of Newark silt loam. This is a nearly level, somewhat poorly drained, loamy soil on flood plains.

The soil has a deep rooting zone, high available moisture capacity, and moderate permeability. It is neutral to mildly alkaline. Seasonal wetness and susceptibility to flooding are the main limitations.

If this soil is drained, corn and tobacco can be grown year after year on the same area. Pasture and hay plants that withstand slight wetness are suited to this soil. Some of these plants are Kentucky 31 tall fescue, reed canarygrass, redtop, red clover, alsike clover, Ladino clover, Korean lespedeza, and Kobe lespedeza.

Tile drainage and open-ditch drainage can be used to help correct the seasonal wetness. The general principles of management that apply to fertilization, maintenance of organic-matter content, and tillage practices are important in managing this soil.

CAPABILITY UNIT IIs–1

This unit consists of moderately well drained and well-drained, nearly level soils in the Egam and Chagrin series. These soils are moderately fine textured. They are susceptible to flooding.

These soils have a deep rooting zone. The available moisture capacity is high, except in the Chagrin soils, which have a moderate capacity because of the gravel content. Permeability is moderate to moderately slow; natural fertility is high. The soils are neutral to mildly alkaline. There is no erosion hazard, but these soils are

difficult to till properly because of their moderately fine texture and the gravel in the Chagrin soil.

The soils in this unit are suited to corn or tobacco year after year on the same area. Some of the suited pasture and hay plants are Kentucky 31 tall fescue, orchardgrass, smooth bromegrass, timothy, Ladino clover, Korean lespedeza, and sericea lespedeza. Alfalfa and small grain are suited where winter and spring flooding is not a severe hazard.

The general principles of management that apply to fertilization, maintenance of organic-matter content, and tillage practices are important in managing these soils.

CAPABILITY UNIT IIIe-1

This unit consists of sloping, well-drained loamy soils of the Chavies, Negley, and Wheeling series. These soils occupy stream terraces and upland areas.

These soils have a deep rooting zone, high available moisture capacity, and moderate to moderately rapid permeability. They are strongly acid to very strongly acid unless limed. The major limitation to use of the soils is a severe erosion hazard if cultivated crops are grown.

Crops common in the survey area, such as corn, tobacco, and small grain, are suited to the soils in this unit. Some of the pasture and hay plants that grow well are Kentucky bluegrass, Kentucky 31 tall fescue, smooth bromegrass, orchardgrass, red clover, alfalfa, Ladino clover, and Korean lespedeza. Truck crops, orchards, vineyards, and nursery stock are also suited to the soils in this unit. When these soils are cultivated, a combination of a cropping system and erosion control practices helps to slow surface runoff and reduce soil loss caused by erosion.

CAPABILITY UNIT IIIe-2

This unit consists of sloping, well-drained and moderately well drained soils of the Brashear, Faywood, Jessup, Licking, and Woolper series. These soils have a silt loam or silty clay loam plow layer and a clayey lower subsoil. They are on stream terraces, foot slopes, and uplands.

These soils have a moderately deep to deep rooting zone, moderate to high available moisture capacity, and moderately slow to slow permeability. Woolper and Brashear soils range from medium acid to mildly alkaline. The other soils are strongly acid to slightly acid unless limed. The Jessup silt loam is easy to till. The other soils in this unit are more difficult to till properly because of the moderately fine texture of the plow layer. The major limitation in these soils is a severe erosion hazard when cultivated crops are grown.

Crops common in the survey area, such as corn, tobacco, and small grain, are suited to the soils in this unit. Some of the suited pasture and meadow plants are orchardgrass, Kentucky 31 tall fescue, timothy, alfalfa, red clover, white clover, sericea lespedeza, and Korean lespedeza. When these soils are cultivated, a combination of a cropping system and erosion control practices helps to slow surface runoff and reduce loss caused by erosion.

CAPABILITY UNIT IIIe-3

This unit consists of sloping, moderately well drained soils of the Captina, Nicholson, and Rossmoyne series. These are loamy soils that have a fragipan at a depth of 18 to 28 inches. They occupy stream terraces and upland areas.

These soils have a moderately deep rooting zone over the fragipan, and they have moderate available moisture capacity. Permeability is moderate above the fragipan. The soils are strongly acid where unlimed. The major limitation to use is a severe erosion hazard when cultivated crops are grown.

Crops common in the survey area, such as corn, tobacco, and small grain, are suited to the soils of this unit. Some of the suited pasture and hay plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 tall fescue, orchardgrass, timothy, red clover, Ladino clover, white clover, sericea lespedeza, and Korean lespedeza. Alfalfa tends to die on these soils in 2 to 3 years because the fragipan restricts rooting depth and causes wetness in the rooting zone during periods of heavy rainfall.

When soils are cultivated, a combination of a cropping system and erosion control practices helps to slow surface runoff and reduce soil loss caused by erosion.

CAPABILITY UNIT IIIw-1

This unit consists of nearly level, somewhat poorly drained soils of the Avonburg, Lawrence, and Licking series. Avonburg and Lawrence soils are underlain by a fragipan at a depth of 14 to 18 inches. The Licking soil in this unit lacks a fragipan, but the subsoil at a depth below 15 to 20 inches is dense silty clay. Licking silt loam is normally moderately well drained, but areas of this soil in this unit are more nearly somewhat poorly drained.

The slowly permeable fragipan or clay subsoil restricts root growth and causes a seasonal water table to remain near the surface after heavy rainfall. The soils in this unit have a moderate available moisture capacity and are strongly acid unless limed. Seasonal wetness and limited depth to the fragipan or dense silty clay are the main limitations to the use of these soils. Tile drainage is not effective, because permeability is slow.

Unless they are drained, these soils are poorly suited to most row crops and pasture and hay plants. When the soils are drained, corn can be grown year after year. Tobacco and small grain crops generally are not grown on these soils. Pasture and hay plants that withstand moderate wetness, such as Kentucky 31 fescue, redtop, reed canarygrass, red clover, alsike clover, Ladino clover, and Kobe and Korean lespedeza are suited to these soils.

Open-ditch drains in combination with a constructed grassed waterway help to correct excessive wetness. The general principles of management that apply to fertilization, maintenance of organic-matter content, and minimum tillage practices are important in managing these soils.

CAPABILITY UNIT IIIs-1

This unit consists of nearly level to sloping, excessively drained sandy soils of the Lakin series. These soils occupy stream terraces along the Ohio River.

These soils have a deep rooting zone, low available moisture capacity, and rapid permeability. Natural fertility is low, and the soils are strongly acid unless limed.

Droughtiness and low natural fertility are the main limitations to growing row crops on these soils. If the soils are irrigated, truck crops, especially melons, grow well on the soils in this unit. Corn is usually the only

row crop grown. Suitable pasture and hay plants include Kentucky 31 tall fescue and sericea lespedeza.

The general principles of management that apply to fertilization, maintenance of organic-matter content, and tillage practices are important in managing these soils. Where the steeper areas are cultivated, some erosion control practices are needed to guard against concentration of runoff and consquent erosion.

CAPABILITY UNIT IVe–1

This unit consists of moderately steep, well drained and moderately well drained soils of the Brashear, Faywood, Jessup, Licking, and Woolper series. They have a silt loam or silty clay loam plow layer and a clayey lower subsoil.

These soils have a moderately deep to deep rooting zone, moderate to high available moisture capacity, and moderate to slow permeability. Reaction ranges from very strongly acid to mildly alkaline. Except for Negley silt loam, these soils are difficult to till properly because of a moderately fine textured plow layer. The major limitation to the use of these soils is a very severe erosion hazard when cultivated crops are grown.

Row crops common in the survey area, such as corn and tobacco, are suited to the soils in this unit, but pasture or hay are better uses. Some of the suitable pasture and meadow plants are orchardgrass, Kentucky 31 tall fescue, alfalfa, red clover, white clover, and sericea lespedza. Korean lespedeza is suitable if grown in a mixture with grasses.

If these soils are cultivated, a combination of a cropping system and erosion control practices helps to slow surface runoff and reduce soil loss caused by erosion.

CAPABILITY UNIT IVw–1

This unit consists of Robertsville silt loam, a nearly level, poorly drained soil on stream terraces. This soil has a slowly permeable fragipan at a depth of about 13 inches that restricts root growth and causes a seasonal water table to remain near the surface for long periods after heavy rainfall. This soil has low available moisture capacity and is strongly acid or very strongly acid unless limed. Wetness and shallowness to a fragipan are the main limitations.

Suitability of this soil for corn or tobacco is limited because adequate drainage is made difficult by the slow permeability. The soil is poorly suited to fall-seeded small grains. Suitable pasture and hay plants include Kentucky 31 tall fescue, reed canarygrass, redtop, Ladino clover, and Kobe lespedeza.

Tile drainage is generally not feasible for this soil because of shallowness to the fragipan and a lack of suitable outlets. A combination of surface drainage ditches and constructed grassed waterways helps to correct the wetness of this soil. The general principles of management that apply to fertilization, maintenance of organic-matter content, and tillage practices are important in managing this soil.

CAPABILITY UNIT Vw–1

This unit consists of Boonesboro silt loam, a nearly level, moderately deep, well-drained soil on narrow flood plains.

This soil has a moderately deep rooting zone and moderate available moisture capacity. Permeability is moderate in the upper part and rapid in the lower part. The soil is neutral to mildly alkaline. Because this soil is subject to frequent flooding and is gravelly throughout the subsoil, it is poorly suited to cultivation. It is, however, suited to pasture or hay. Some of the suitable pasture and hay plants are Kentucky 31 tall fescue, reed canarygrass, sericea lespedza, red and Ladino clover, and Korean and Kobe lespedeza.

Because of the hazard of flooding on this soil, management of vegetation for ground cover and protection is most important. Pasture mixtures should be selected that will produce satisfactory forage, give adequate ground cover, and require the least frequent renovation of the pasture.

CAPABILITY UNIT VIe–1

This unit consists of moderately steep, severely eroded soils of the Brashear, Faywood, Jessup, and Licking series; moderately steep soils of the Eden and Cynthiana series; and steep soils of the Eden and Jessup series. These are mostly well-drained soils that have a loamy to clayey surface layer and a clayey lower subsoil.

Rooting zones are moderately deep to deep, except in the Cynthiana soils, which are shallow to bedrock. Available moisture capacity is moderate to high except in the Cynthiana soils, which have low available moisture capacity. Permeability is moderately slow to slow. The soils are strongly acid to mildly alkaline. Most of the soils in this unit are hard to till because of the clay content of the plow layer. Because of steepness, the effects of past severe erosion, and the hazard of continued erosion, they are not suited for cultivation.

These soils are suited to pasture or hay, but harvesting of hay is very difficult on the steep soils. Some of the suitable grasses and legumes are Kentucky 31 tall fescue, and sericea lespedeza. Korean lespedeza is suitable on these soils only if it is grown in a mixture with grasses.

Because of the erosion hazard, management of vegetation for ground cover and soil protection is most important on these soils. Pasture mixtures should be selected that will produce satisfactory forage, adequate ground cover, and require the least frequent renovation of pastures.

CAPABILITY UNIT VIIe–1

This unit consists of Cynthiana flaggy silty clay loam, 20 to 50 percent slopes. This soil has a silty clay loam surface layer and clayey subsoil. The rooting zone is shallow, available moisture capacity is low, and permeability is moderately slow. The soil is neutral to mildly alkaline.

Because of the slope and the hazard of erosion, this soil is not suited to crops or hay. Flagstone and steep slopes interfere with the use of machinery on this soil. Limited pasture is a suitable use, but the soil is better suited to woodland or wildlife habitat. If used for pasture, the selection of suitable plants is limited. Plants should be used that give the best protection to the soil and yield some forage. Grazing periods should be short, with long recovery periods in between to allow regrowth of the plants. Kentucky 31 tall fescue and sericea lespedeza are suitable. The use of fertilizer is generally not worthwhile.

CAPABILITY UNIT VIIe-2

This unit consists of Gullied land. The soil material is highly erodible, and the available moisture capacity is very low. It is extremely acid to moderately alkaline. Gullies make the use of machinery extremely difficult. Very few areas of Gullied land can be reclaimed economically for crops or pasture. Gullied land is better suited to woodland or wildlife.

Estimated yields

Table 2 gives estimated average yields of the crops most commonly grown in the survey area under two levels of management.

Yields given are the average that may be expected over a period of several years. Yields for any given year may be affected adversely by extremes of weather, by insects or disease, or by some other disaster; or the yields may be extremely high because conditions are unusually favorable.

A comparison of yields shown in columns A with yields shown in columns B shows the differences that may be expected by improving management.

A high level of management includes: (1) the use of suitable varieties; (2) proper seeding rates, inoculation of legumes, proper dates of planting, and efficient harvesting methods; (3) control of weeds, insects, and plant disease; (4) fertilizer application that is equal to or greater than the current recommendations of the University of Kentucky Agricultural Experiment Station, or that is equal to or greater than the need shown by properly interpreted soil tests; (5) adequate applications of lime; (6) artificial drainage for naturally wet soils if drainage is feasible; (7) cropping systems that control erosion and maintain soil structure, tilth, and organic-matter content; (8) application of erosion control measures, such as contour tillage, terracing, contour strip-cropping, and use of grassed waterways; (9) use of cover crops and crop residue to increase supplies of organic matter and to control erosion; (10) use of all the applicable pasture management practices; and (11) the use of management practices, such as minimum tillage, seeding winter crops with row crops, and other applicable practices.

The high-level management referred to is not a maximum level but is one that many farmers find practical to maintain. It is a level of management that will result in high sustained production, and it is economically feasible.

The failure to adequately apply one or more of the listed high-level management practices may cause production levels to drop. Inadequate drainage or only partial application of runoff and erosion control practices are examples of deficiencies that are typical of medium-level management.

Use of the Soils for Woodland [3]

This section describes the woodland of Boone, Campbell, and Kenton Counties, explains woodland suitability groupings of soils, and discusses the potential of the soil groups for producing tree crops. The limitations of the

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TABLE 2.—*Estimated average yields per acre of the principal crops under two levels of management*

Yields in columns A are expected under a medium level of management; those in columns B are expected under a high level of management. Absence of a yield figure indicates that the particular crop is not suited to the soil. Alluvial land, steep; Urban land; and Gullied land are too variable for estimates to be made]

Soil	Tobacco [1]	Corn		Wheat		Hay						Pasture (tall fescue and legumes)	
						Alfalfa		Red clover and grass		Lespedeza (Korean, Kobe)			
	B	A	B	A	B	A	B	A	B	A	B	A	B
	Lb.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Animal-unit-days* [2]	*Animal-unit-days* [2]
Ashton silt loam, 0 to 2 percent slopes	3, 200	105	135	30	45	3. 5	5. 0	1. 1	3. 0	1. 6	2. 5	170	260
Ashton silt loam, 2 to 6 percent slopes	3, 200	100	130	30	45	3. 2	4. 9	1. 1	3. 0	1. 6	2. 5	160	260
Avonburg silt loam		55	70	12	21					1. 4	2. 3	115	190
Boonesboro silt loam						1. 5	3. 3	1. 1	3. 0	1. 0	1. 8	75	190
Brashear silty clay loam, 6 to 12 percent slopes	2, 600	70	90	20	30	2. 5	4. 2	1. 1	2. 9	1. 4	2. 3	125	240
Brashear silty clay loam, 12 to 20 percent slopes	2, 400	60	75	18	28	2. 0	3. 9	1. 0	2. 7			100	220
Brashear silty clay, 12 to 20 percent slopes, severely eroded						1. 8	3. 5	. 7	2. 0			90	204
Captina silt loam, 2 to 6 percent slopes	2, 650	80	100	23	35	2. 2	3. 5	1. 1	2. 8	1. 5	2. 4	130	200
Captina silt loam, 6 to 12 percent slopes	2, 400	70	90	20	30	2. 0	3. 5	. 9	2. 3	1. 4	2. 3	120	200
Chagrin gravelly silty clay loam	2, 500	80	100	23	35	3. 0	4. 5	1. 1	3. 8	1. 5	2. 4	150	250
Chavies fine sandy loam, 0 to 6 percent slopes	2, 800	80	100	22	35	2. 8	4. 2	1. 1	2. 9	1. 5	2. 4	140	240
Chavies fine sandy loam, 6 to 12 percent slopes	2, 600	75	95	20	35	2. 7	4. 1	1. 1	2. 8	1. 4	2. 3	135	235

See footnotes at end of table.

TABLE 2.—*Estimated average yields per acre of the principal crops under two levels of management*—Continued

Soil	To-bacco [1]	Corn		Wheat		Hay						Pasture (tall fescue and legumes)	
						Alfalfa		Red clover and grass		Lespedeza (Korean, Kobe)			
	B	A	B	A	B	A	B	A	B	A	B	A	B
	Lb.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Animal-unit-days* [2]	*Animal-unit-days* [2]
Cynthiana flaggy silty clay loam, 12 to 20 percent slopes								0.4	1.1			60	125
Cynthiana flaggy silty clay loam, 20 to 50 percent slopes												30	110
Eden silty clay loam, 12 to 20 percent slopes, eroded	1,800	55	70			2.0	3.6	.9	2.3			100	205
Eden silty clay loam, 20 to 35 percent slopes, eroded						1.5	3.1	.6	1.6			80	175
Egam silty clay loam	2,800	100	130	28	40	3.0	4.5	1.0	2.6	1.6	2.5	150	255
Faywood silt loam, 2 to 6 percent slopes	2,400	70	90	15	25	2.1	4.0	.9	2.5	1.2	2.0	105	230
Faywood silty clay loam, 6 to 12 percent slopes	2,100	55	75	14	23	2.0	3.8	.9	2.3	1.1	1.9	100	215
Faywood silty clay loam, 12 to 20 percent slopes	1,900	40	55	12	20	1.8	3.5	.8	2.2			90	200
Faywood silty clay, 12 to 20 percent slopes, severely eroded						1.5	2.9	.6	1.7			75	165
Huntington fine sandy loam	2,800	90	115	[3] 30	[3] 45	[3] 3.0	[3] 4.5	1.1	3.0	1.4	2.3	175	255
Huntington silt loam	3,000	110	130	[3] 35	[3] 45	[3] 3.5	[3] 5.0	1.1	3.0	1.6	2.5	175	285
Jessup silt loam, 2 to 6 percent slopes	2,600	80	100	23	35	2.5	4.2	1.1	3.0	1.5	2.4	125	240
Jessup silt loam, 6 to 12 percent slopes	2,300	70	90	20	30	2.3	4.0	1.1	3.0	1.4	2.3	115	230
Jessup silt loam, 12 to 20 percent slopes	2,100	60	75	18	28	2.0	3.8	1.1	3.0			100	215
Jessup silt loam, 20 to 30 percent slopes						1.8	3.5	1.1	3.0			90	200
Jessup silty clay loam, 12 to 20 percent slopes, severely eroded	1,800					1.5	3.0	.9	2.5			75	170
Lakin loamy fine sand, 0 to 2 percent slopes	2,100	60	75	15	25	1.5	2.8	1.7	1.8	1.0	1.8	75	160
Lakin loamy fine sand, 2 to 12 percent slopes	1,900	50	65	12	21	1.5	2.8	.7	1.9	.9	1.6	75	160
Lawrence silt loam		55	75	12	21					1.4	2.3	130	225
Licking silt loam, 0 to 2 percent slopes		60	75	10	20			.8	2.0	1.4	2.3	130	225
Licking silt loam, 2 to 6 percent slopes	2,600	80	100	23	35	2.2	4.2	1.1	3.0	1.5	2.4	110	240
Licking silty clay loam, 6 to 12 percent slopes	2,300	70	90	20	30	2.1	4.0	1.0	2.7	1.4	2.3	105	230
Licking silty clay loam, 12 to 20 percent slopes	2,100	60	75	18	28	2.0	3.8	1.0	2.6			100	220
Licking silty clay, 12 to 20 percent slopes, severely eroded						1.5	3.1	.8	2.1			75	180
Lindside silt loam	2,800	100	130	[3] 28	[3] 40	[3] 2.5	[3] 4.5	1.1	3.0	1.6	2.5	175	250
Negley silt loam, 2 to 6 percent slopes	2,500	70	90	15	25	2.5	4.0	1.1	3.0	1.2	2.0	125	230
Negley silt loam, 6 to 12 percent slopes	2,200	65	80	14	23	2.3	3.8	1.1	2.9	1.1	1.9	115	225
Negley silt loam, 12 to 20 percent slopes	1,900	55	70	12	20	1.8	3.5	1.1	2.8			90	205
Newark silt loam	2,400	75	110	[3] 23	[3] 35			.9	2.5	1.5	2.4	140	235
Nicholson silt loam, 0 to 6 percent slopes	3,025	90	110	27	40	2.5	4.0	1.1	3.0	1.6	2.5	125	230
Nicholson silt loam, 6 to 12 percent slopes	2,700	75	95	23	35	2.4	3.8	1.0	2.8	1.4	2.3	120	220
Nolin silt loam	3,000	110	135	35	45	3.0	5.0	1.1	3.0	1.6	2.5	170	285
Robertsville silt loam		40	60							1.3	2.1	115	200
Rossmoyne silt loam, 0 to 6 percent slopes	2,750	85	110	25	37	2.2	3.5	1.1	2.9	1.5	2.4	115	220
Rossmoyne silt loam, 6 to 12 percent slopes	2,300	75	95	22	32	2.0	3.8	1.0	2.7	1.4	2.3	115	220
Wheeling silt loam, 0 to 2 percent slopes	3,200	100	130	30	45	3.0	5.0	1.1	3.0	1.6	2.5	150	285
Wheeling silt loam, 2 to 6 percent slopes	3,200	95	130	30	45	3.0	4.9	1.1	3.0	1.6	2.5	150	280
Wheeling silt loam, 6 to 12 percent slopes	2,800	70	115	26	35	2.4	4.4	1.1	3.0	1.5	2.4	120	250
Woolper silty clay loam, 6 to 12 percent slopes	2,500	80	100	20	30	3.0	4.5	1.8	2.8	1.4	2.3	150	250
Woolper silty clay loam, 12 to 20 percent slopes	2,400	60	80	18	28	2.3	3.8	1.7	2.6			115	200

[1] Tobacco is a high-value crop and is nearly always grown under a high level of management. Yields under medium management are not estimated.

[2] Animal-unit-days is a term used to express the carrying capacity of pasture. It is the number of calendar days during a year that an acre can be grazed by a mature cow, horse, steer, five hogs, or seven sheep without injury to the pasture. Estimates given are for tall fescue and a legume.

[3] Yield estimates do not allow for damage by flooding.

soils as they affect woodland management are also discussed.

Originally Boone, Campbell, and Kenton Counties were covered with deciduous forest. Except for a few areas, the total area of the three counties was subsequently cleared for farming. Isolated forested areas along the bluffs of the Licking and Ohio Rivers are exceptions. Because of the influence of the Greater Cincinnati Metropolitan Area, much of the area originally cleared for farms has been abandoned and taken over by deciduous woody growth of low commercial value. In some areas relatively good stands of black walnut and white oak are still being produced, however.

The market for black walnut is favorable because of the evtensive use of the wood for veneer and furniture. Overseas buyers are paying premium prices for walnut veneer logs. The market demand for top quality white oak is also very good. Considerable quantities of black walnut and white oak are being harvested annually.

In Boone, Campbell, and Kenton Counties, much of the woodland is now being converted to urban development. The remaining woodland areas are steep and generally unsuitable for urban use. Black walnut and other hardwoods are especially well suited to the deep, well-drained, loamy soils on flood plains, stream terraces, and on the foot slopes that have north and east exposures.

Better management of the woodland in this survey area will increase the productivity of these areas. This management must relate to the characteristics of the soils.

Woodland suitability grouping

The soils of Boone, Campbell, and Kenton Counties have been placed in woodland suitability groups. Each group is made up of soils that are suitable for similar kinds of wood crops, that need similar management, and are about equal in productivity.

The groupings are based on the similarity of (1) potential productivity for several kinds of trees, (2) species to favor in managing existing woodland, (3) species preferred for planting, and (4) soil-related hazards and limitations that affect woodland management.

The potential productivity is expressed as a site index, or the expected height in feet that a tree species or forest type will attain on a specified kind of soil or group of soils at a specified age—50 years for most species. The wood crop site index ratings shown for each woodland suitability group are expressed as a range in height, usually 10 feet or less. For example, the site index of upland oaks on soils in woodland group 1 is 75-85.

Many trees in this area and in similar adjacent areas were measured in the process of gathering data from which to determine site index ratings. As nearly as possible, the sample measurements were made in well-stocked, naturally occurring, even-aged, essentially unmanaged stands that had not been adversely affected by fire, insects, or disease and that had not been grazed excessively.

The average height and age measurements gathered on different tree species were converted to site index by using the site index curves in published research papers (*3*, *4*, *5*, *7*). The site index curves used in determining the ratings for redcedar were developed from observations on 271 plots in the Tennessee Valley.

Site index can be converted to a volumetric prediction of growth and yield which can be shown in wood measurements, such as board feet per acre. Average yearly growth per acre is is given in board feet, International ¼-inch scale (*8*, *11*, *12*). Yearly growth estimates are to age 60 per yellow-poplar and the oaks and to age 50 for other species.

Erosion hazard is the degree of potential soil erosion that may occur following cutting operations and where the soil is exposed along roads, skid trails, fire lanes, and landing areas. It is assumed that the woodland is well managed and is protected from fire and grazing.

Soil characteristics or properties considered in rating erosion hazard include slope, texture and structure of the surface soil, permeability of the subsoil, water storage capacity, and resistance to detachment of soil particles by rainfall and runoff.

Relative ratings are used to indicate the intensity of erosion control measures needed to reduce erosion. Slight indicates that no special measures are needed. Moderate indicates that some attention needs to be given to the prevention of soil erosion. Severe indicates that intensive erosion control measures are needed.

Woodland can be protected from erosion by carefully constructing and maintaining roads, trails, fire lanes, and landings.

The equipment limitation is influenced by topographic features and soil characteristics, such as slope, drainage, soil texture, stoniness, and rockiness, that restrict the use of conventional wheeled or track-type equipment for harvesting and planting wood crops, for constructing roads, controlling fire, and for controlling unwanted vegetation. Topographic conditions and differences in soils make it necessary to use different kinds of equipment and methods of operation. Generally, the limitation is slight if the slope is 12 percent or less and farm machinery can be operated efficiently without the construction and maintenance of permanent roads and truck trails. The rating is moderate if the slope is 12 to 30 percent, if the use of ordinary farm machinery is limited, if track-type equipment is necessary for efficient harvesting, or if soil wetness prevents the use of logging vehicles for 2 to 6 months. The rating is severe if the slope is more than 30 percent, if track-type equipment is not adequate for harvesting, or if wetness prevents the use of vehicles for 6 months or more.

Plant competition refers to the unwanted trees, vines, shrubs, and other plants that invade a site when openings are made in the canopy. This competition hinders the establishment and normal development of desirable seedlings, whether they occur naturally or are planted. Plant competition is slight if unwanted plants do not prevent adequate natural regeneration, interfere with early growth, or restrict the normal development of planted stock. Competition is moderate if unwanted plants delay establishment and hinder the growth of either planted stock or naturally regenerated seedlings, or if they retard the eventful development of a fully stocked stand. Competition is severe if unwanted plants prevent adequate restocking, either by natural regeneration or by planting, without intensive site preparation or special maintenance practices.

Some loss of seedlings is expected if soil characteristics

or topographic features are unfavorable, even though plant competition is not a factor. Seedling mortality is slight if the expected loss is not more than 25 percent of the number needed to provide optimum stocking. Mortality is moderate if the expected loss is between 25 and 50 percent; it is severe if the expected loss is more than 50 percent. If the rating is moderate or severe, replanting will generally be needed to insure a fully stocked stand, and special preparation of the seedbed and special planting techniques are often necessary.

In the following discussions of the woodland suitability groups, a brief description of the soils in each group is given, and evaluation of potential wood crop productivity is made for each group.

WOODLAND SUITABILITY GROUP 1

This group consists of deep, well-drained, nearly level to moderately steep soils of the Ashton, Chavies, Negley, and Wheeling series. These soils are loamy and are on stream terraces and uplands.

The range of site index is 75–85 for upland oaks and 90–100 for yellow-poplar.

The average yearly growth per acre is approximately 300 board feet for the oaks and 500 board feet for yellow-poplar. This rate of production justifies intensive management.

The species to favor in existing stands are yellow-poplar, white oak, northern red oak, white ash, black walnut, black cherry, and sugar maple. The species to favor in plantings are yellow-poplar, white oak, red oak, black walnut, white pine, shortleaf pine, and Virginia pine.

The erosion hazard is slight for these soils.

The use of equipment is slightly limited on all of the soils in this group except Negley silt loam, 12 to 20 percent slopes, on which it is moderately limited.

Plant competition is moderate for hardwoods and severe for conifers. Where trees are cut for saw logs, shade-tolerant trees of low quality may interfere with the establishment and growth of desirable naturally regenerated or planted seedlings. One or more weedings is generally necessary to control undesirable vegetation. Normally, tree planting or interplanting is not feasible, because of the weeding requirements involved.

Seedling mortality is slight.

WOODLAND SUITABILITY GROUP 2

This group consists of deep, well-drained, nearly level soils of the Boonesboro, Chagrin, Egam, Huntington, Lindside, and Nolin series.

Trees that are common in the uplands and those common in the lowlands grow equally well on the soils in this group. Upland hardwoods, such as black walnut, yellow-poplar, and upland oaks, are not well suited to some areas of these soils where flooding is a limitation during the growing season.

Site index ranges for the rated species are: lowland oak, 90–100; cottonwood, 100–110; sweetgum, 90–100; and yellow-poplar, 100–110. Production is high enough to justify intensive management. The average yearly growth per acre for the oaks is approximately 455 board feet; for sweetgum, 500 board feet, and for cottonwood it is about 720 board feet. It is about 550 board feet by yellow-poplar.

The species to favor in existing stands are the lowland oaks, cottonwood, and sweetgum. Yellow-poplar and black walnut should also be favored. Species to favor for planting are white oak, yellow-poplar, shortleaf pine, black walnut, black locust, and white pine.

Erosion hazard, equipment limitation, and seedling mortality are slight.

Plant competition is moderate for hardwoods and severe for conifers. Shade-tolerant trees of low quality receive a favorable supply of moisture during the growing season, and the trees are able to establish themselves in the understory of saw log stands. Following the removal of the overstory after logging, these low-quality shade-tolerant trees tend to prevent the reestablishment of desirable trees, or they inhibit growth of the desirable types unless intensive weeding treatment is applied. Interplanting or conversion planting generally is not feasible, because competition from undesirable trees is severe. Trees planted in open fields usually require one or more cultivations.

WOODLAND SUITABILITY GROUP 3

This group consists of nearly level, somewhat poorly drained and poorly drained soils of the Avonburg, Lawrence, Licking, Newark, and Robertsville series. These soils are on upland terraces and flood plains. Avonburg, Lawrence, and Robertsville soils have a fragipan. The Licking soils lack a fragipan but have a dense, clayey subsoil. Newark soils lack a fragipan and are loamy throughout.

Site index ranges for the rated species are: lowland oak, 95–105; sweetgum, 90–100; yellow-poplar 85–95; and upland oaks, 70–80. Intensive management is justified. The average yearly growth per acre of the lowland oaks is approximately 510 board feet; for upland oaks it is 250 board feet. It is about 500 board feet for sweetgum, and 450 board feet for yellow-poplar.

The species of trees that are tolerant of long periods of excess water in the soil are well suited to these soils. Hardwoods, such as yellow-poplar and upland oaks, are moderately productive on the soils in this group that are susceptible to frequent, prolonged flooding. The species to favor in managing existing stands are pin oak, white and red oak, sweetgum, yellow-poplar, Virginia pine, and sugar maple. The species to favor in planting are yellow-poplar, pin oak, sweetgum, white oak, loblolly pine, and Virginia pine.

The erosion hazard is slight. The equipment limitation is moderate for Avonburg, Lawrence, Licking, and Newark soils and severe for Robertsville soils.

Plant competition is severe for hardwoods and conifers. Shade-tolerant trees of low quality grow in the understory of saw log stands. When the stands have been cut, these shade-tolerant trees tend to prevent the satisfactory reestablishment of desirable naturally regenerated or planted seedlings. Unless the site is weeded intensively to release desirable seedings, trees planted in open fields may require one or more cultivations.

The seedling mortality is severe.

WOODLAND SUITABILITY GROUP 4

This group consists of gently sloping to sloping soils of the Captina, Nicholson, and Rossmoyne series. These soils are moderately well drained and moderately deep to a fragipan.

Site index ranges for the rated species are: upland oaks, 70–80; yellow-poplar, 90–100; Virginia pine, 65–75; and sweetgum, 80–90. The average yearly growth per acre is approximately 240 board feet for the oaks; 500 board feet for yellow-poplar; and 490 board feet for Virginia pine. Production justifies intensive management.

The species to favor in existing stands are yellow-poplar, white and red oak, black oak, white ash, sugar maple, black walnut, and black cherry. The species to favor in plantings are yellow-poplar, black locust, loblolly pine, and white oak.

The hazard of erosion and the limitations on equipment use are slight.

Plant competition is slight for hardwoods and moderate for conifers. In the growing season, plants receive a moderate supply of moisture from these soils, and low-quality shade-tolerant trees are encouraged to invade and establish themselves in the understory of saw log stands. When the overstory is logged, the low-quality trees often prevent the satisfactory reestablishment of desirable trees. One or more weedings may be required to control undesirable vegetation in established stands and in newly planted areas.

Seedling mortality is slight.

WOODLAND SUITABILITY GROUP 5

This group consists of deep, excessively drained, sandy soils of the Lakin series. These soils are nearly level to sloping soils on uplands and terraces.

Site index ranges for the rated species are: upland oak, 65–75; yellow-popular, 85–95; and Virginia pine, 70–80. The average yearly growth per acre for the oaks is approximately 200 board feet; for yellow-poplar, 450 board feet; and for Virginia pine, 540 board feet. Production is generally high enough to justify intensive management.

The species to favor in existing stands are yellow-poplar, white and red oak, black locust, and Virginia pine. The species to favor for planting are loblolly pine, Virginia pine, and shortleaf pine.

The erosion hazard on these sandy soils is slight.

Plant competition is slight for hardwoods and moderate for conifers. When sufficient moisture is available during the growing season, low-quality trees establish themselves in the understory of saw log stands. These shade-tolerant trees compete with naturally regenerated desirable seedlings or planted trees when the overstory trees are harvested. A weeding to release desirable seedlings may be necessary.

Equipment limitations are moderate. The sandy texture of the soils restricts the use of farm-type equipment; track-type equipment may be necessary for harvesting the wood crops.

Seedling mortality is severe to moderate. It is severe when droughty conditions occur during the early part of the growing season.

WOODLAND SUITABILITY GROUP 6

This group consists of deep, gently sloping to moderately steep soils of the Brashear, Faywood, Jessup, Licking, and Woolper series. These are well drained to moderately well drained soils that have a clayey lower subsoil.

Site index ranges for the rated species are: oaks, 70–80; yellow-poplar, 90–100; shortleaf pine, 70–80; and Virginia pine, 70–80. The average yearly growth per acre for the oaks is approximately 240 board feet. It is about 500 board feet for yellow-poplar; 670 board feet for shortleaf pine; and 540 board feet for Virginia pine. Intensive management is justified.

The species to favor in managing existing stands are yellow-poplar, white oak, northern red oak, sugar maple, black walnut, white pine, shortleaf pine, black oak, white ash, black cherry, and basswood. The species to favor in planting are yellow-poplar, black walnut, black locust, white oak, northern red oak, white pine, shortleaf pine, and white ash.

The erosion hazard is slight to moderate on most of the soils in this group. The Faywood and Licking soils, which have slopes of 12 to 20 percent, have a rating of severe.

Equipment limitation is slight to moderate on slopes ranging from 0 to 12 percent and is severe on slopes exceeding 12 percent. Track-type equipment or winches may be required to harvest the timber efficiently.

Plant competition is moderate for hardwoods and severe for conifers. One or more weedings generally is necessary to control competing vegetation.

Seedling mortality is slight to moderate.

WOODLAND SUITABILITY GROUP 7

This group consists of moderately steep to very steep soils of the Brashear, Cynthiana, Eden, Faywood, Jessup, and Licking series. These soils are moderately deep to deep, except for Cynthiana soils, which are shallow to limestone bedrock. Soils of this group are well drained or moderately well drained, eroded or severely eroded, and they have a clayey lower subsoil.

Site index ranges for the rated species are: oaks, 55–65; Virginia pine, 65–75; and redcedar, 45–55. The average yearly growth per acre is approximately 120 board feet for oaks and 490 board feet for Virginia pine. A medium intensity of management is justified on these soils.

The species to favor in existing stands are white oak, black oak, scarlet oak, red oak, Virginia pine, eastern redcedar, and shortleaf pine. The species to favor in planting are white pine, shortleaf pine, Virginia pine, and eastern redcedar.

The erosion hazard is severe, and provisions must be made for the proper location, construction, and maintenance of roads and skid trails.

The equipment limitation is severe. The use of track-type equipment or power winches is often necessary to harvest wood crops efficiently.

Plant competition is slight for hardwoods and conifers.

Seedling mortality is moderate to severe. Short drought periods of one or more weeks occur in the early part of the growing season in some years. These may cause moderate to severe losses of newly regenerated or planted trees.

WOODLAND SUITABILITY GROUP 8

This group consists of Gullied land, Urban land, and Alluvial land, steep. These land types are so variable in origin, soil characteristics, physiography, behavior, and management requirements that onsite inspection is necessary before interpretations can be made regarding growth and management of trees.

Use of the Soils for Wildlife

This section deals with the suitability of the soils for growing plants that furnish food and cover for wildlife. In table 3 the soils are rated for supporting the elements of wildlife habitat. The classes or kinds of wildlife supported are also indicated.

Successful management of wildlife on any tract of land requires, among other things, that food, cover, and water be available in a suitable combination. Lack of any one of these necessities, unfavorable balance between them, or inadequate distribution of them may severely limit desired wildlife species.

Most wildlife habitat is managed by planning suitable vegetation or manipulating existing vegetation to bring about the establishment, increase, or improvement of desired plants. Water areas can be created or natural ponds improved.

Soil interpretations for wildlife habitat serve a variety of purposes. They are an aid in selecting the more suitable sites for various kinds of habitat management. They serve as indicators of the level of management intensity needed to achieve satisfactory results. They also serve as a means of showing why it may not be feasible generally to manage a particular area for a given kind of wildlife.

These interpretations also may serve in broad-scale planning of wildlife management areas, parks, and nature areas, or for acquiring wildlife lands. By means of colored map overlays, individual habitat element suitabilities or groupings may be made.

The soil areas shown on the soil survey maps are rated without regard to positional relationships with adjoining areas. The size, shape, or location of the outlined areas do not affect the rating. Certain influences on wildlife habitat, such as elevation and aspect, must be evaluated onsite.

In table 3 the soils in this survey area are rated for their relative suitability for the creation, improvement, or maintenance of eight wildlife habitat elements for openland, woodland, and wetland classes of wildlife. These ratings are based on limitations imposed by the characteristics or behavior of the soil. Three levels of suitability are recognized. It also is recognized that certain conditions render a site unsuited to a particular habitat element. Numerical ratings of 1 to 4 indicate the degree of soil suitability for a given habitat element. They also indicate the relative extent of soil limitations.

Special attention is directed to the rating of Coniferous Woody Plant Habitat. There is a considerable body of evidence indicating that under situations of slow growth and delayed canopy closure coniferous habitats harbor larger numbers and varieties of wildlife than under rapid growth conditions. Soil properties, therefore, which tend to promote rapid growth and canopy closure limit the use and management of a soil for wildlife.

In general, soil conditions favorable to quick establishment of conifers and their rapid growth require more intensive management to achieve satisfactory results for long-term use by wildlife. Therefore, soils rated as poorly suited for coniferous woody plants may provide easy establishment and temporary or short-term value for wildlife habitat.

TABLE 3.—*Rating of soils for elements of wildlife habitat and kinds of wildlife*

[A rating of 1 denotes well suited or above average; 2 denotes suitable or average; 3 denotes poorly suited or below average; and 4 denotes unsuited. A dash indicates soil was not rated]

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland	Woodland	Wetland
Alluvial land, steep: AlD	4	2	2	1	2	4	4	4	4	2	4
Ashton:											
AsA	1	1	1	1	3	4	4	4	1	1	4
AsB	2	1	1	1	3	4	4	4	1	1	4
Avonburg: Av	3	3	2	2	2	3	2	2	3	2	2
Boonesboro: Bo	4	3	1	1	3	4	4	4	2	2	2
Brashear:											
BrC	2	1	1	1	3	4	4	4	1	1	4
BrD	3	2	1	1	3	4	4	4	2	1	4
BsD3	4	2	2	1	3	4	4	4	2	2	4

TABLE 3.—*Rating of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland	Woodland	Wetland
Captina: CaB, CaC	2	1	1	1	3	4	4	4	1	1	4
Chagrin: Cg	2	1	1	1	3	4	4	4	1	1	4
Chavies: ChB, ChC	2	1	1	1	3	4	4	4	1	1	4
Cynthiana: CyD, CyF	4	3	2	2	2	4	4	4	3	2	4
Eden:											
EdD2	3	2	1	1	2	4	4	4	1	1	4
EdE2	4	2	1	1	2	4	4	4	2	1	4
Egam: Eg	2	1	1	1	3	3	3	3	1	2	3
Faywood:											
FaB, FcC	2	1	1	1	3	4	4	4	1	1	4
FcD	3	2	1	1	3	4	4	4	2	2	4
FdD3	4	2	2	2	2	4	4	4	3	2	4
Gullied land: Gu	4	4	3	3	2	4	4	4	3	3	4
Huntington: Hn, Hu	2	1	1	1	3	4	4	4	1	1	4
Jessup:											
JeB, JeC	2	1	1	1	3	4	4	4	2	1	4
JeD	3	2	1	1	3	4	4	4	1	1	4
JeE	4	2	1	1	3	4	4	4	2	2	4
JsD3	4	2	2	1	3	4	4	4	2	2	4
Lakin: LaA, LaC	3	3	3	3	1	4	4	4	3	3	4
Lawrence: Lc	3	2	2	2	2	3	2	2	2	2	2
Licking:											
LkA	3	2	1	1	3	3	2	2	2	2	3
LkB, LlC	2	1	1	1	3	4	4	4	1	1	4
LlD	3	2	1	1	3	4	4	4	2	1	4
LmD3	4	2	2	1	3	4	4	4	2	2	4
Lindside: Ln	2	1	1	1	3	3	3	3	1	1	3
Negley:											
NeB, NeC	2	1	1	1	3	4	4	4	1	1	4
NeD	3	2	1	1	3	4	4	4	2	2	4
Newark: Nk	3	2	1	1	3	3	2	3	2	2	2
Nicholson: NlB, NlC	2	1	1	1	3	4	4	4	1	1	4
Nolin: No	2	1	1	1	3	4	4	4	1	1	4
Robertsville: Ro	3	3	2	2	2	3	1	1	3	2	2
Rossmoyne: RsB, RsC	2	1	1	1	3	4	4	4	1	1	4
Urban land: Ur											
Wheeling:											
WhA	1	1	1	1	3	4	4	4	1	1	4
WhB, WhC	2	1	1	1	3	4	4	4	1	1	4
Woolper:											
WoC	2	1	1	1	3	4	4	4	1	1	4
WoD	3	2	1	1	3	4	4	4	2	1	4

The following definitions are given for suitability ratings:

Well suited (1): Soil limitations are negligible in the management of the designated habitat element. Generally, the intensity of management required for the creation, improvement, or maintenance of the habitat element is low, and satisfactory results are well assured.

Suited (2): Soil limitations moderately affect the management of the designated habitat element. Fairly frequent attention and a moderate intensity of effort is required to achieve satisfactory results.

Poorly suited (3): Soil limitations are severe. The creation, improvement, or maintenance of the designated habitat element is difficult, may be expensive, and requires intensive effort to attain satisfactory results.

Unsuited (4): Conditions for which a rating of unsuited are given are those where the soil properties are such that it is highly impractical, if not impossible, to manage the designated habitat element.

The eight wildlife habitat elements rated in table 3 are defined as follows:

GRAIN AND SEED CROPS.—Agricultural grains or seed-producing annuals planted to produce food for wildlife. Examples are corn, sorghums, wheat, oats, millet, buckwheat, soybeans, and sunflowers.

GRASSES AND LEGUMES.—Domestic perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife food and cover. Examples are fescue, bromegrass, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and panicgrass.

WILD HERBACEOUS UPLAND PLANTS.—Native or introduced perennial grasses and forbs (weeds) that provide food and cover principally to upland forms of wildlife, and that are established mainly through natural processes. Examples are bluestem, indiangrass, wheatgrass, wild ryegrass, oatgrass; pokeweed, strawberries, lespedeza, beggarweed, wild beans, nightshade, goldenrod, and dandelions.

HARDWOOD WOODY PLANTS.—Nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs (browse), or foilage used extensively as food by wildlife, and which commonly are established through natural processes but also may be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnum, maple, birch, poplar, grapes, honeysuckle, blueberry, briers, greenbriers, autumn olive, and multiflora rose.

CONIFEROUS WOODY PLANTS.—Cone-bearing trees and shrubs, important to wildlife mainly as cover, but also may furnish food in the form of browse, seeds, or fruitlike cones. Plants commonly are established through natural processes but also may be planted. Examples are pine, hemlock, redcedar, juniper, and yew.

WETLAND FOOD AND COVER PLANTS.—Annual and perennial, wild herbaceous plants in moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover that is extensively and dominantly used by wetland forms of wildlife. Examples are smartweed, wild millet, bulrush, spike sedge, rushes, sedges, burreed, rice cutgrass, and cattails.

SHALLOW WATER DEVELOPMENTS.—Impoundments or excavations for control of water generally not exceeding 6 feet in depth. Examples are low dikes and levees, shallow dugouts, level ditches, and devices for water level control in marshy drainageways or channels.

EXCAVATED PONDS.—Dug-out water areas or combinations of dug-out areas and low dikes (dammed areas) that have water of suitable quality, of suitable depth, and in ample supply for production of fish or wildlife. An example is a pond built on nearly level soil of at least one-fourth acre surface area, having an average depth of 6 feet for at least one-fourth of its area, and having a dependably high water table or other source of water.

Table 3 contains ratings based upon weighted values of selected habitat elements that show the relative value of each soil for three main classes of wildlife; namely, openland, woodland, and wetland wildlife. These classes are defined as follows:

OPENLAND WILDLIFE.—Birds and mammals that normally make their homes on cropland, pastures, meadows, lawns, and areas overgrown with grasses, herbs, and shrubby plants. Examples are quail, meadowlarks, field sparrows, doves, cottontail rabbits, red foxes, and woodchucks.

WOODLAND WILDLIFE.—Birds and mammals that normally make their homes in areas wooded with hardwood trees and shrubs, coniferous trees and shrubs, or mixtures of such plants. Examples are ruffed grouse, woodcock, thrushes, vireos, scarlet tanagers, gray squirrels, gray fox, white-tailed deer, raccoon, and wild turkey.

WETLAND WILDLIFE.—Birds and mammals that normally make their homes in wet areas such as ponds, marshes, and swamps. Examples are ducks, geese, herons, shore birds, mink, muskrat, and beaver.

Engineering Uses of the Soils [4]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. This section contains information about those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, density, shrink-swell potential, available water capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties are furnished in tables 4, 5, and 6. The estimates and interpretations of soil properties in these tables can be used to:

1. Plan agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Select potential locations for highways, airports, pipelines, and underground cables.
3. Select potential industrial, commercial, residential, and recreational areas.

[4] ARTHUR T. SMITH, area engineer, Soil Conservation Service, helped prepare this section.

The engineering interpretations reported here do not eliminate the need for investigating, sampling, and testing at the site of specific engineering works, especially where excavations are deeper than the depths of layers described in this survey. This soil survey can be useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

The soil or soils represented by a map symbol can be reasonably expected to make up the major part of a mapping unit, but small areas of dissimilar soils are included in mapping.

Engineering classification of the soils

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system (*1*, *10*) adopted by the American Association of State Highway Officials and the Unified System (*17*) used by the Soil Conservation Service, Department of Defense, and others.

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength. These are the best soils for subgrade (foundation). At the other extreme are the clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A–1, the next best A–2, and so on to class A–7, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. If soil material is near a classification boundary, it is given a symbol showing both classes; for example, A–2 or A–4. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, ML–CL.

Estimated engineering properties

Table 4 provides estimates of soil properties important in engineering. The properties are shown for a representative profile of each soil series. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and on detailed experience in working with the individual kind of soil in the survey area.

Some of the properties shown in the table need no explanation. Others are either defined in the Glossary or are explained as follows:

Seasonal high water table refers to the upper limits of soil saturated with water during the seasons of high rainfall, either as perched water that is separated from the ground water by a nearly impervious soil layer or as a part of the ground water.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. These terms used in the USDA textural classification are defined in the Glossary.

Permeability, as used in table 4, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available moisture capacity is that amount of capillary water in the soil available for plant growth after all free water has drained away. It is expressed in table 4 as inches per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Interpretations of engineering properties

Table 5 contains information useful to engineers and others who are interested in soil features that affect highway location, farm pond construction, agricultural drainage, irrigation, and the construction of terraces, diversions, and waterways. Detrimental or limiting soil features are emphasized. The ratings and other interpretations in this table are based on estimated engineering properties of the soils in table 4, on available test data, and on field experience. The interpretations apply generally to soil depths indicated in table 4, and they are reasonably reliable to depths of about 5 feet for most of the soils.

The soils are rated in the table as a source of topsoil and road fill. Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as a topdressing for lawns, gardens, roadbanks, and other similar areas. Road fill is material used to build embankments (fig. 8, see p. 50). The ratings indicate performance of soil material moved from borrow areas for these purposes.

Highway location is influenced by features of undisturbed soil (fig. 9, see p. 51) that affect construction and maintenance of highways. The soil features noted in the table are the principal ones that affect geographic locations of highways.

Farm pond reservoir areas are affected mainly by seepage loss of water, and the soil features are those that influence such seepage.

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TABLE 4.—*Estimated engineering*

[Estimates are not made for Alluvial land, steep; Gullied land; or Urban land, because their

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Ashton: AsA, AsB	10+	6+	0–18	Silt loam	ML–CL or ML	A–4 or A–6
			18–30	Silty clay loam	CL or ML–CL	A–6
			30–50	Silt loam	ML–CL	A–4 or A–6
Avonburg: Av	10+	[1] ½–1	0–16	Silt loam	ML–CL or ML	A–4
			16–24	Silt loam	ML–CL	A–6
			24–36	Silty clay loam (fragipan).	ML–CL	A–6
			36–50	Silty clay	MH–CH	A–7
Boonesboro: Bo [2]	1½–3½	4+	0–21	Silt loam	ML–CL or ML	A–4
			21–34	Gravelly silt loam.	ML–CL or GM	A–4, A–1 or A–2
Brashear: BrC, BrD, BsD3	4–10+	2–3	0–7	Silty clay loam	ML–CL	A–6
			7–18	Silty clay loam	CL	A–6 or A–7
			18–60	Silty clay	MH–CH	A–7
Captina: CaB, CaC	10+	[1] 1½–2	0–10	Silt loam	ML–CL	A–4
			10–20	Silty clay loam	CL or ML–CL	A–6
			20–50	Silty clay loam (fragipan).	ML–CL or CL	A–6
Chagrin: Cg [2]	4–10+	4+	0–50	Gravelly silty clay loam.	CL or ML–CL	A–6
Chavies: ChB, ChC	10+	5+	0–22	Fine sandy loam.	SM	A–4
			22–40	Fine sandy loam.	SM–SC or SM	A–2, A–6 or A–4
			40–50	Fine sand	SM or SP–SM	A–2, A–3 or A–1
Cynthiana: CyD, CyF	1–1½	6+	0–4	Flaggy silty clay loam.	ML–CL	A–7, A–6
			4–18	Flaggy silty clay.	ML–CL or MH–CH	A–7
Eden: EdD2, EdE2	3½–5	6+	0–5	Silty clay loam.	ML–CL	A–6, A–7
			5–50	Silty clay	MH–CH, CL or CH	A–7
Egam: Eg [2]	10+	1½–3	0–13	Silty clay loam.	CL or ML–CL	A–7
			13–50	Silty clay loam.	CL or ML–CL	A–7
Faywood: FaB, FcC, FcD, FdD3	2–3½	6+	0–18	Silty clay loam.	ML–CL or CL	A–6 or A–7
			18–27	Clay	MH or CH	A–7
			27–36	Clay	CH	A–7
Huntington:						
Hn [2]	10+	4+	0–50	Silt loam	ML–CL or ML	A–6
Hu [2]	10+	4+	0–50	Fine sandy loam.	SM	A–4
Jessup: JeB, JeC, JeD, JeE, JsD3	4–10+	6+	0–4	Silt loam	ML–CL	A–4 or A–6
			4–15	Silty clay loam.	ML–CL	A–6
			15–60	Silty clay	MH–CH or ML–CL	A–7

See footnotes at end of table.

properties of the soils

properties are too variable. The symbol < means less than; the symbol > means more than]

Percentage passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH*	
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	6. 1–7. 3	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	6. 1–6. 5	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	6. 1–6. 5	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–6. 0	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–5. 5	Low.
100	100	95–100	85–95	<0. 20	0. 08–0. 12	4. 5–5. 0	Low.
100	100	95–100	90–95	<0. 20	0. 15–0. 18	4. 5–5. 0	Moderate.
65–100	60–100	55–95	55–85	0. 63–2. 00	0. 12–0. 18	6. 6–7. 8	Low.
70–85	70–85	20–80	15–75	>6. 30	0. 12–0. 13	6. 6–7. 8	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	6. 1–7. 8	Low.
100	100	95–100	85–95	0. 20–0. 63	0. 16–0. 17	7. 4–7. 8	Moderate.
100	100	95–100	90–95	0. 20–0. 63	0. 15–0. 18	7. 4–7. 8	High.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–6. 5	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	5. 1–5. 5	Low.
100	100	95–100	85–95	<0. 20	0. 08–0. 12	5. 1–5. 5	Low.
70–85	70–85	65–80	60–75	0. 63–2. 00	0. 12–0. 13	6. 6–7. 8	Low.
100	100	70–85	40–50	2. 00–6. 30	0. 13–0. 16	5. 1–5. 5	Low.
100	100	80–90	35–50	2. 00–6. 30	0. 13–0. 16	5. 1–5. 5	Low.
100	100	65–80	10–25	>6. 30	0. 02–0. 05	5. 1–5. 5	Low.
85–95	85–95	80–95	75–90	0. 63–2. 00	0. 11–0. 13	6. 6–7. 3	Low.
80–95	80–95	80–95	75–95	0. 20–0. 63	0. 11–0. 13	7. 4–8. 4	Moderate.
95–100	95–100	95–100	90–100	0. 20–0. 63	0. 14–0. 16	6. 1–6. 5	Moderate.
95–100	95–100	95–100	90–100	<0. 20	0. 13–0. 16	6. 6–8. 4	High.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	6. 6–7. 8	Moderate.
100	100	95–100	85–95	0. 20–0. 63	0. 16–0. 17	6. 6–7. 8	Moderate.
100	100	95–100	85–95	0. 20–0. 63	0. 16–0. 17	5. 6–6. 5	Moderate.
100	100	95–100	90–95	0. 20–0. 63	0. 15–0. 18	5. 6–6. 5	High.
100	100	95–100	90–95	0. 20–0. 63	0. 14–0. 17	6. 1–7. 3	High.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	6. 6–7. 8	Low.
100	100	70–85	40–50	2. 00–6. 30	0. 13–0. 16	6. 6–7. 8	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 6–7. 3	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	5. 6–7. 3	Moderate.
100	100	95–100	90–95	0. 20–0. 63	0. 15–0. 18	5. 6–7. 3	High.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Lakin: LaA, LaC	10+	6+	0–50	Loamy fine sand.	SM	A–2 or A–1
Lawrence: Lc	10+	[1] ½–1	0–12	Silt loam	ML–CL or ML	A–4
			12–17	Silty clay loam.	ML–CL	A–6
			17–50	Silty clay loam (fragipan).	ML–CL or CL	A–7 or A–6
Licking:						
LkA	10+	½–1½	0–11	Silt loam	ML–CL	A–4
			11–18	Silty clay	ML–CL or CL	A–7
			18–35	Clay	CL or CH	A–7
			35–50	Silty clay	MH–CH or CH	A–7
LkB, LkC, LkD, LmD3	10+	2–3	0–6	Silt loam	ML–CL or CL	A–4
			6–17	Silty clay loam.	ML–CL or CL	A–6
			17–25	Silty clay	CH or MH–CH	A–7
			25–50	Clay	MH–CH or CH	A–7
Lindside: Ln [2]	10+	1½–2	0–50	Silt loam	ML–CL or ML	A–6 or A–4
Negley: NeB, NeC, NeD	10+	6+	0–12	Silt loam	ML–CL or ML	A–4
			12–16	Silty clay loam	ML–CL	A–6
			16–28	Loam	ML–CL	A–4
			28–38	Fine sandy loam.	SM or ML	A–4
			38–50	Sandy clay loam.	SC or CL	A–2, A–4 or A–6
Newark: Nk [2]	10+	½–1½	0–36	Silt loam	ML–CL	A–6 or A–4
			36–63	Silty clay loam	ML–CL	A–6
Nicholson: NlB, NlC	5–8+	[1] 2–3	0–13	Silt loam	ML–CL or ML	A–4
			13–26	Silty clay loam	CL or ML–CL	A–6
			26–36	Silty clay loam (fragipan).	ML–CL	A–6
			36–50	Silty clay	MH–CH or CH	A–7
Nolin: No [2]	10+	4+	0–50	Silt loam	ML–CL or ML	A–4 or A–6
Robertsville: Ro	10+	[1] 0–½	0–13	Silt loam	ML–CL or ML	A–4
			13–50	Silty clay loam (fragipan).	CL or ML–CL	A–6
Rossmoyne: RsB, RsC	10+	[1] 1–2	0–11	Silt loam	ML–CL or ML	A–4
			11–21	Silty clay loam	ML–CL or MH	A–6 or A–7
			21–52	Silty clay loam or clay loam (fragipan).	CL or ML–CL	A–6
			52–60	Silty clay	MH–CH or CH	A–7
Wheeling: WhA, WhB, WhC	10+	6+	0–13	Silt loam	ML–CL or ML	A–4
			13–44	Silty clay loam	ML–CL	A–6
			44–50	Silt loam	ML	A–4
Woolper: WoC, WoD	3–10+	3+	0–8	Silty clay loam	CL	A–6
			8–33	Silty clay	MH–CH	A–7
			33–60	Clay	MH–CH or CH	A–7

[1] Perched water table.
[2] Soils are subject to flooding.

properties of the soils—Continued

Percentage passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH*	
100	100	50–75	15–30	>6. 30	0. 06–0. 08	5. 1–6. 0	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–6. 0	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	5. 1–5. 5	Low.
100	100	95–100	85–95	<0. 20	0. 08–0. 12	4. 5–5. 0	Low.
100	100	90–100	80–100	0. 63–2. 00	0. 19–0. 23	5. 1–6. 5	Low.
100	100	95–100	90–100	<0. 20	0. 15–0. 18	5. 1–5. 5	High.
100	100	95–100	95–100	<0. 20	0. 14–0. 17	5. 1–5. 5	High.
100	100	95–100	90–100	<0. 20	0. 15–0. 18	5. 1–7. 8	High.
100	100	90–100	80–100	0. 63–2. 00	0. 19–0. 23	5. 1–6. 0	Low.
100	100	95–100	85–95	0. 20–0. 63	0. 16–0. 17	5. 1–5. 5	Moderate.
100	100	95–100	90–100	0. 20–0. 63	0. 15–0. 18	5. 1–5. 5	High.
100	100	95–100	90–100	0. 06–0. 63	0. 14–0. 17	5. 1–7. 8	High.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	6. 6–7. 8	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	4. 5–5. 0	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	4. 5–5. 0	Low.
100	85–100	85–95	60–75	0. 63–2. 00	0. 15–0. 18	4. 5–5. 0	Low.
100	85–100	70–85	40–55	2. 00–6. 30	0. 13–0. 16	4. 5–5. 0	Low.
100	85–100	80–90	35–55	0. 63–2. 00	0. 15–0. 18	4. 5–5. 0	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	6. 6–7. 8	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	6. 6–7. 8	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–7. 3	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	5. 1–5. 5	Moderate.
100	100	95–100	85–95	<0. 20	0. 08–0. 12	5. 1–5. 5	Low.
100	100	95–100	90–95	<0. 20	0. 15–0. 18	5. 6–6. 5	High.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	6. 1–7. 3	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	4. 5–5. 5	Low.
100	100	95–100	85–95	<0. 20	0. 08–0. 12	4. 5–5. 0	Low.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–6. 0	Moderate.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	5. 1–5. 5	Moderate.
100	100	90–100	70–95	<0. 20	0. 08–0. 12	4. 5–5. 5	Moderate.
100	100	95–100	90–95	<0. 20	0. 15–0. 18	5. 5–7. 8	High.
100	100	90–100	70–90	0. 63–2. 00	0. 19–0. 23	5. 1–6. 0	Low.
100	100	95–100	85–95	0. 63–2. 00	0. 16–0. 17	5. 1–5. 5	Low.
95–100	95–100	90–100	70–90	2. 00–6. 30	0. 19–0. 23	5. 1–5. 5	Low.
100	100	95–100	85–95	0. 20–0. 63	0. 16–0. 17	5. 6–6. 0	Moderate.
100	100	95–100	90–95	0. 20–0. 63	0. 15–0. 18	6. 6–7. 3	High.
100	100	95–100	90–95	0. 20–0. 63	0. 14–0. 17	7. 4–7. 8	High.

TABLE 5.—*Interpretations of*

[Interpretations are not made for Alluvial land, steep; Gullied

Soil series and map symbols	Suitability as source of—		Soil features affecting—
	Topsoil	Road fill	Highway location
Ashton: AsA, AsB	Good: nearly neutral; high in fertility.	Poor to fair: A–4 to A–6 material; moderate plasticity.	Infrequent flooding
Avonburg: Av	Good above fragipan, fine textured below fragipan.	Poor: A–6 to A–7 material; moderate to high plasticity.	Seasonal water table at a depth of 6 to 12 inches.
Boonesboro: Bo	Fair to good except for stones and gravel at a depth below 21 inches.	Fair to good: A–1 to A–4 material.	Subject to flooding
Brashear: BrC, BrD, BsD3	Poor: moderately fine textured surface layer; fine textured subsoil.	Poor: A–6 to A–7 material; moderate to high plasticity.	Slope; high compressibility; moderate to high shrink-swell potential.
Captina: CaB, CaC	Good above fragipan	Fair to poor: A–6 material; plastic.	Seasonal water table at a depth of 1½ to 2 feet; medium compressibility.
Chagrin: Cg	Poor: gravelly	Fair: A–6 material; plastic	Subject to flooding; medium compressibility.
Chavies: ChB, ChC	Good	Good	All features favorable
Cynthiana: CyD, CyF	Poor: fine textured; flaggy; shallow.	Poor: A–7 material; high plasticity; 1 to 2 feet to rock.	1 to 2 feet to rock; steep; high compressibility.
Eden: EdD2, EdE2	Poor: fine textured	Poor: A–7 material; high plasticity.	Generally steep; danger of slipping.
Egam: Eg	Fair: moderately fine textured; nonacid; high fertility.	Poor: A–7 material; high plasticity.	Subject to flooding; medium to high compressibility.
Faywood: FaB, FcC, FcD, FdD3	Poor: moderately fine to fine textured subsoil; moderate fertility.	Poor: A–7 material; high plasticity.	2 to 3½ feet to rock; moderate to high shrink-swell potential.
Huntington: Hn, Hu	Good: nonacid; high fertility.	Fair: A–4 or A–6 material; moderate plasticity.	Subject to flooding
Jessup: JeB, JeC, JeD, JeE, JsD3	Poor: moderately fine to fine textured subsoil; moderate fertility.	Poor: A–6 to A–7 material; high plasticity.	Slope; moderate to high shrink-swell potential.

engineering properties of the soils

land; or Urban land, because features are too variable]

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation (sprinkler)	Diversion terraces	Grassed waterways
Reservoir area	Embankment				
Porous material may cause seepage.	Good to fair stability; medium compressibility.	Well drained	Features generally favorable.	Features generally favorable.	Features generally favorable.
Impervious material under fragipan; deep to rock.	Fair strength and stability; medium compressibility.	Fragipan at a depth of about 16 inches; seasonal water table at a depth of 6 to 12 inches.	Shallow rooting zone; slow permeability.	Nearly level	Some seepage from side slopes.
Excessive seepage in subsoil; subject to flooding.	Susceptible to piping; subject to flooding.	Well drained	Bedrock at a depth of 1½ to 3½ feet; rapid permeability at a depth below 21 inches.	Soils on flood plains: generally not needed.	Soils on flood plains: generally not needed.
Impervious; 4 to 10 feet to bedrock.	Poor compaction qualities; moderate to high shrink-swell potential.	Well drained	Moderately slow permeability.	Some slopes greater than 10 percent.	Highly erodible.
Some areas somewhat porous below fragipan.	Fair to good stability; medium compressibility.	Fragipan at a depth of about 20 inches; slow permeability.	Shallow rooting zone; slowly permeable in fragipan.	Some ponding in channel.	Some seepage from side slopes.
Subject to flooding; seepage in subsoil.	Fair to good stability; subject to flooding.	Well drained	Subject to flooding.	Soils on flood plains: generally not needed.	Soils on flood plains: generally not needed.
Porous material; deep to rock.	Susceptible to piping; moderate permeability.	Well drained	Moderately rapid permeability.	All features favorable.	Erodible.
Creviced limestone at a depth of 1 to 2 feet.	Very little material available; high compressibility.	Well drained	1 to 2 feet to rock; slope.	1 to 2 feet to rock; slope.	Flaggy; 1 to 2 feet to rock; slope.
Steep side slopes; thin layers of limestone allow seepage in some places.	Fair: high compressibility.	Well drained	Slow permeability; slope.	Steep slopes	Highly erodible.
Subject to flooding	Fair to good stability; medium to high compressibility.	Seasonal high water table at a depth of 1½ to 3 feet.	Surface tends to puddle; moderately slow permeability.	Subject to flooding.	Soils on flood plains: generally not needed.
Clay material; 2 to 3 feet to creviced limestone that allows seepage in some places.	Poor to fair stability; high compressibility.	Well drained	Moderately slow permeability; slope.	Channel highly erodible; some moderately steep slopes.	Poor workability; erodible on steep slopes.
Seepage in subsoil; subject to flooding.	Susceptible to piping; fair stability.	Well drained	Features generally favorable.	Subject to flooding.	Soils on flood plains: generally not needed.
Impervious material at a depth below 1½ feet; deep to rock.	Fair to poor stability; high compressibility.	Well drained	Moderately slow permeability.	Slope	Highly erodible.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—
	Topsoil	Road fill	Highway location
Lakin: LaA, LaC	Fair: low available moisture capacity.	Fair to good: A–1 or A–2 material; deep to rock.	Sandy
Lawrence: Lc	Fair: acid; moderate fertility.	Poor: A–6 to A–7 material; high plasticity.	Seasonal water table at a depth of ½ to 1 foot.
Licking: LkA	Poor: fine textured at a depth below 17 inches.	Poor: A–7 material; high plasticity.	Seasonal water table at a depth of ½ to 1½ feet; moderate to high shrink-swell potential.
LkB, LIC, LID, LmD3	Fair to poor: fine textured at a depth below 17 inches.	Poor: A–6 to A–7 material; high plasticity.	Slope: moderate to high shrink-swell potential; 2 to 3 feet to seasonal high water table.
Lindside: Ln	Good: nonacid; moderate fertility; subject to flooding.	Fair: A–4 to A–6 material; moderate plasticity.	Subject to flooding; seasonal water table at a depth of 1½ to 2 feet.
Negley: NeB, NeC, NeD	Good: acid	Fair: A–4 to A–6 material; moderate plasticity.	Medium compressibility
Newark: Nk	Good: nonacid; moderate fertility.	Fair to poor: A–4 to A–6 material; high plasticity.	Subject to flooding; seasonal water table at a depth of ½ to 1 foot.
Nicholson: NIB, NIC	Good above fragipan; fine textured below fragipan.	Poor: A–6 to A–7 material; high plasticity.	Seasonal water table at a depth of 2 to 3 feet.
Nolin: No	Good: nonacid; high fertility.	Fair: A–4 to A–6 material; moderate plasticity; subject to flooding.	Subject to flooding
Robertsville: Ro	Fair: 0 to ½ foot to seasonal water table; acid.	Fair to poor: A–6 material; seasonal high water table at a depth of ½ to 1 foot.	Seasonal water table at a depth of 0 to ½ foot.

properties of the soils—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation (sprinkler)	Diversion terraces	Grassed waterways
Reservoir area	Embankment				
Porous material	Fair stability; susceptible to piping.	Excessively drained.	Rapid permeability; low in fertility; low available moisture capacity.	Erodible	Erodible; droughty; low fertility.
Seasonal high water table at a depth of ½ to 1 foot; porous under fragipan in places; deep to rock.	Fair stability; medium to high compressibility.	Fragipan at a depth of about 17 inches; seasonal water table at a depth of ½ to 1 foot.	Shallow rooting zone.	Nearly level	Seepage from side slopes.
Seasonal high water table at a depth of ½ to 1½ feet; nearly level.	Fair to poor stability; high compressibility.	Clayey subsoil; slow permeability; seasonal high water table at a depth of ½ to 1½ feet.	Slow permeability	Nearly level	Seepage occurs from side slopes; seasonal high water table at a depth of 1 to 1½ feet.
Thin sandy layers below 50 inches in places.	Fair to poor stability; medium to high compressibility.	Clayey subsoil; moderately slow permeability; seasonal high water table at a depth of 2 to 3 feet.	Moderately slow permeability.	Channel highly erodible; slope in some areas.	Highly erodible on slopes; clayey subsoil.
Excessive seepage in subsoil; subject to flooding.	Susceptible to piping; poor to fair stability.	Seasonal water table at a depth of 1½ to 2 feet; subject to flooding.	Subject to flooding.	Subject to flooding.	Flood plain.
Subsoil subject to seepage	Fair to good stability; medium compressibility.	Well drained	Moderately steep in some areas.	Features generally favorable.	Erodible on steeper slopes.
Seepage in substratum; subject to flooding.	Fair stability; susceptible to piping; medium compressibility.	Subject to flooding; seasonal water table at a depth of ½ to 1 foot.	Subject to flooding.	Subject to flooding; ½ to 1 foot to seasonal high water table.	Soils on flood plains: generally not needed.
Impervious material below fragipan; limestone bedrock at a depth of 5 feet or more.	Fair stability; medium to high compressibility.	Well drained to moderately well drained in fragipan.	Moderately deep rooting zone; slow permeability.	Features generally favorable.	Some seepage from side slopes.
Excessive seepage in substratum; subject to flooding.	Susceptible to piping; fair stability.	Well drained	Subject to flooding.	Subject to flooding.	Soils on flood plains: generally not needed.
Seasonal water table at a depth of 0 to ½ foot; nearly level.	Fair stability; medium to high compressibility.	Slowly permeable fragipan at a depth of about 13 inches; seasonal water table at a depth of 0 to ½ foot.	Shallow rooting zone; slow permeability.	Nearly level	Seasonal high water table at a depth of 0 to ½ foot; seepage occurs from side slopes.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—
	Topsoil	Road fill	Highway location
Rossmoyne: RsB, RsC	Good above fragipan; fine textured below fragipan.	Poor: A–6 to A–7 material; high plasticity.	Seasonal water table at a depth of 1 to 2 feet; moderate shrink-swell potential at a depth of less than 52 inches; high shrink-swell potential at a depth of more than 52 inches.
Wheeling: WhA, WhB, WhC	Good: acid; moderate fertility.	Fair: A–4 to A–6 material; moderate plasticity.	Medium compressibility
Woolper: WoC, WoD	Poor: fine textured at a depth below 8 inches.	Poor: A–7 material; high plasticity; high compressibility.	Highly plastic; high shrink-swell potential.

TABLE 6.—*Engineering*

[Tests performed by the Kentucky Department of Highways Research Laboratory, Lexington, in

Soil name and location of sample	Parent material	Depth from surface	Moisture-density data [1]		Mechanical analysis [2]— Percentage passing sieve—	
			Maximum dry density	Optimum moisture	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)
		Inches	*Lb. per cu. ft.*	*Percent*		
Eden silty clay loam: 2 miles southeast of Morning View (modal profile).	Calcareous shale and limestone slabs.	4–15	92	28	----------	100
		15–30	95	26	100	98
Licking silt loam: 1 mile south of Claryville (modal profile)	Alkaline slack water clay.	1–7	100	20	100	99
		10–18	94	26	100	99
		18–27	89	29	----------	100
		50–96	98	24	----------	----------
Rossmoyne silt loam: 1 mile north of Richwood (modal profile)	Loess over calcareous glacial till material.	4–9	99	23	100	97
		14–22	95	25	100	98
		22–36	97	24	100	98
		54–90	88	23	100	99

[1] Based on AASHO Designation T 99–57, Method A (*1*).

[2] Mechanical analyses according to AASHO Designation T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser

properties of the soils—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation (sprinkler)	Diversion terraces	Grassed waterways
Reservoir area	Embankment				
Impervious material below fragipan; deep to rock.	Fair stability; medium to high compressibility.	Seasonal high water table at a depth of 1 to 2 feet; slow permeability in fragipan.	Moderately deep rooting zone; slow permeability.	Features generally favorable.	Some seepage from side slopes; erodible in sloping areas.
Pervious layers below 4 feet.	Fair to good stability.	Well drained	Features generally favorable.	Features generally favorable.	Erodible in sloping areas.
Sloping to moderately steep	Poor compaction qualities; high compressibility.	Well drained	Moderately slow permeability.	Clayey subsoil; some areas moderately steep.	Erodible slopes; clayey subsoil.

test data

accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]—Continued					Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued	Percentage smaller than—							
No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
					Percent			
99	98	93	73	58	51	22	A–7–6(15)	MH–CH
95	94	88	64	46	49	25	A–7–6(16)	CL
97	89	68	31	17	26	8	A–4(8)	CL
96	94	88	52	37	35	14	A–6(10)	CL
98	98	15	81	63	59	32	A–7–6(20)	CH
100	99	96	82	60	50	24	A–7–6(14)	MH–CH
87	81	64	32	20	28	5	A–4(8)	ML–CL
94	90	74	36	29	38	15	A–6(10)	ML–CL
93	88	72	35	28	38	11	A–6(8)	ML–CL
94	93	86	62	52	50	24	A–7–6(15)	MH–CH

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[3] Based on AASHO Designation M 145–49 (*1*).

[4] Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points of A-line are to be given a borderline classification. An example of a borderline classification obtained by this use is MH–CH.

Figure 8.—**Fill material from Jessup soils is highly erodible.**

Farm pond embankments serve as dams. The features of disturbed soil from both subsoil and substratum are those important in the use of soils for constructing embankments.

Agricultural drainage is influenced by features of the undisturbed soil that affect the installation and performance of surface and subsurface drainage installations.

Irrigation is affected by features of undisturbed soil that influence soil moisture relations and the potential of a soil to produce specific crops. Before planning an irrigation project, a feasibility study made by a qualified consultant is desirable.

Terraces and diversions are affected by soil features that influence their stability or hinder layout and construction. Also, hazards of sedimentation in channels and difficulty of establishment and maintenance of cover are important considerations for diversions.

Grassed waterways are affected by soil features important to the establishment, growth, and maintenance of plants or that affect layout and construction.

Engineering test data

Table 6 contains the results of engineering tests performed by the Kentucky Department of Highways Research Laboratory on three types of soil that occur in the survey area.

Maximum dry density is the maximum unit dry weight of the soil when it has been compacted with optimum moisture by the prescribed method of compaction. The moisture content which gives the highest dry unit weight is called the optimum moisture content for the specific method of compaction.

Mechanical analyses show the percentages, by weight, of soil particles that pass sieves of specified sizes. The clay fraction was determined by the hydrometer method, rather than the pipette method most soil scientists use in determining the clay content of soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the

Figure 9.—Eden silty clay loam is subject to much slippage because of the high clay content. Picture shows slippage has caused considerable damage to the road.

plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Town and Country Planning [5]

The soils are a very important consideration in planning most nonfarm and recreational uses of land. The interpretations in this section point out soil-related limitations and problems that can be expected with these kinds of uses. The most severe limitations listed may be overcome if the cost involved can be justified. The information in this section is not intended to eliminate the need for onsite investigations for specific uses, but it can serve as a guide for screening sites and for planning more detailed investigations.

Table 7 shows the estimated degree of limitation and the kinds of limitations that affect certain nonfarm and recreational uses of the soils. The three degrees of limitations are slight, moderate, and severe. Limitations are slight if they are minor and are easily overcome. Limitations are moderate if overcoming them requires careful planning, design, and management. Cost of corrective measures is an important consideration in overcoming a moderate limitation. Limitations are severe if the adverse features are such that the cost of corrective measures may be too high to justify use of the soil for the specified purpose.

The kinds of limitations, expressed in terms of soil characteristics or properties, are shown only for the moderate and severe ratings. Some of the kinds of limitations are expressed in terms that may not be found in a standard dictionary or have special meaning. These are defined in the Glossary at the back of this survey.

The criteria used to rate the soils vary to some extent among the several nonfarm and recreational uses. The ratings in table 7 are based on the factors discussed in the following paragraphs.

[5] E. V. HUFFMAN, assistant State soil scientist, Soil Conservation Service, helped prepare this section.

TABLE 7.—*Limitations of the soils*

[Estimates are not given for Gullied land and Urban land, because

Soil series and map symbols	Septic tank filter fields	Building locations	Campsites	Roads
Alluvial land, steep: AlD	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Ashton: AsA, AsB	Severe: flooded one or more times in 5 years.	Severe: subject to flooding.	Slight	Severe: subject to flooding.
Avonburg: Av	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.
Boonesboro: Bo	Severe: subject to flooding; 1½ to 3½ feet to hard rock.	Severe: subject to flooding; 1½ to 3½ feet to hard rock.	Severe: subject to flooding.	Severe: subject to flooding; 1½ to 3½ feet to hard rock.
Brashear:				
BrC	Severe: moderately slow permeability.	Severe: high shrink-swell potential; slope.	Moderate: slope; moderately slow permeability; silty clay loam surface layer.	Severe: slope; high shrink-swell potential.
BrD	Severe: slope; moderately slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope; high shrink-swell potential.
BsD3	Severe: slope; moderately slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope; silty clay surface layer.	Severe: slope; high shrink-swell potential.
Captina:				
CaB	Severe: slow permeability.	Moderate: seasonal high water table.	Moderate: slow permeability.	Moderate: seasonal high water table.
CaC	Severe: slow permeability.	Moderate: slope; seasonal high water table.	Moderate: slow permeability.	Moderate: slope; seasonal high water table.
Chargrin: Cg	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Chavies:				
ChB	Slight	Slight	Slight	Slight
ChC	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope
Cynthiana:				
CyD	Severe: slope; 1 to 2 feet to rock.	Severe: slope; 1 to 2 feet to rock.	Severe: slope	Severe: slope; 1 to 2 feet to rock.
CyF	Severe: slope; 1 to 2 feet to rock.	Severe: slope; 1 to 2 feet to rock.	Severe: slope	Severe: slope; 1 to 2 feet to rock.
Eden:				
EdD2	Severe: slope; slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope; slow permeability.	Severe: slope; high shrink-swell potential.
EdE2	Severe: slope; slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope; slow permeability.	Severe: slope; high shrink-swell potentail.

or town and country planning

they are too variable to rate and require onsite examination]

Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Sanitary landfills	Cemeteries	Trails
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Slight	Slight	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Slight.
Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: somewhat poorly drained; silty clay loam texture.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.
Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; 1½ to 3½ feet to rock; rapid permeability.	Severe: subject to flooding; 1½ to 3½ feet to hard rock.	Moderate: subject to flooding.
Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Severe: silty clay texture.	Moderate: moderately slow permeability; slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Severe: slope	Severe: slope	Severe: slope	Severe: silty clay texture.	Severe: slope	Moderate: slope; silty clay loam surface layer.
Severe: slope; silty clay surface layer.	Severe: slope; silty clay surface layer.	Severe: slope; silty clay surface layer.	Severe: silty clay texture.	Severe: slope; silty clay surface layer.	Severe: silty clay surface layer.
Moderate: slow permeability; slope; seasonal high water table.	Slight	Slight	Moderate: silty clay loam texture.	Severe: slow permeability.	Slight.
Severe: slope; slow permeability.	Moderate: slope	Moderate: slope	Moderate: silty clay loam texture.	Severe: slow permeability.	Slight.
Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding
Moderate: slope	Slight	Slight	Severe: rapid permeability.	Slight	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Severe: rapid permeability.	Moderate: slope	Slight.
Severe: slope; 1 to 2 feet to rock.	Severe: slope	Severe: slope; 1 to 2 feet to rock.	Severe: 1 to 2 feet to rock; silty clay subsoil.	Severe: slope; 1 to 2 feet to rock.	Moderate: slope; silty clay loam surface layer.
Severe: slope; 1 to 2 feet to rock.	Severe: slope	Severe: slope; 1 to 2 feet to rock.	Severe: slope; silty clay subsoil; 1 to 2 feet to rock.	Severe: slope; 1 to 2 feet to rock.	Severe: slope.
Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: silty clay subsoil; 3½ to 5 feet to rock.	Severe: slope; slow permeability.	Moderate: slope; silty clay loam surface layer.
Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope; silty clay subsoil; 3½ to 5 feet to rock.	Severe: slope; slow permeability.	Severe: slope.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank filter fields	Building locations	Campsites	Roads
Egam: Eg	Severe: subject to flooding; moderately slow permeability.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; moderately slow permeability.	Severe: subject to flooding.
Faywood:				
FaB	Severe: moderately slow permeability; 2 to 3½ feet to rock.	Severe: high shrink-swell potential; 2 to 3½ feet to rock.	Moderate: moderately slow permeability.	Severe: high shrink-swell potential.
FcC	Severe: moderately slow permeability; 2 to 3½ feet to rock.	Severe: high shrink-swell potential; 2 to 3½ feet to rock.	Moderate: moderately slow permeability; slope; silty clay loam surface layer.	Severe: high shrink-swell potential.
FcD	Severe: slope; moderately slow permeability; 2 to 3½ feet to rock.	Severe: slope; high shrink-swell potential; 2 to 3½ feet to rock.	Severe: slope	Severe: slope; high shrink-swell potential.
FdD3	Severe: slope; moderately slow permeability; 2 to 3½ feet to rock.	Severe: slope; high shrink-swell potential; 2 to 3½ feet to rock.	Severe: slope; silty clay surface layer.	Severe: slope; high shrink-swell potential.
Huntington: Hn, Hu	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject flooding.	Severe: subject to flooding.
Jessup:				
JeB	Severe: moderately slow permeability.	Severe: high shrink-swell potential.	Moderate: moderately slow permeability.	Severe: high shrink-swell potential.
JeC	Severe: moderately slow permeability.	Severe: high shrink-swell potential.	Moderate: moderately slow permeability; slope.	Severe: high shrink-swell potential.
JeD	Severe: slope; moderately slow permeability; slope.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope; high shrink-swell potential.
JeE	Severe: slope; moderately slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope; high shrink-swell potential.
JsD3	Severe: slope; moderately slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope; high shrink-swell potential.
Lakin:				
LaA	Slight	Slight	Moderate: loamy sand texture.	Slight
LaC	Moderate: slope	Moderate: slope	Moderate: loamy sand texture; slope.	Moderate: slope
Lawrence: Lc	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.

for town and country planning—Continued

Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Sanitary landfills	Cemeteries	Trails
Moderate: subject to flooding; moderately slow permeability.	Moderate: silty clay loam surface layer.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: silty clay loam surface layer.
Moderate: moderately slow permeability; slope; 2 to 3½ feet to rock.	Slight	Moderate: 2 to 3½ feet to rock.	Severe: 2 to 3½ feet to rock; silty clay subsoil.	Severe: 2 to 3½ feet to rock.	Slight.
Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer; 2 to 3½ feet to rock.	Severe: silty clay subsoil; 2 to 3½ feet to rock.	Severe: 2 to 3½ feet to rock.	Moderate: silty clay loam surface layer.
Severe: slope	Severe: slope	Severe: slope	Severe: silty clay subsoil; 2 to 3½ feet to rock.	Severe: slope; 2 to 3½ feet to rock.	Moderate: slope; silty clay loam surface layer.
Severe: slope; silty clay surface layer.	Severe: slope; silty clay surface layer.	Severe: slope; silty clay surface layer.	Severe: clayey subsoil; 2 to 3½ feet to rock.	Severe: slope; silty clay surface layer; 2 to 3½ feet to rock.	Severe: silty clay surface layer.
Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Moderate: slope; moderately slow permeability.	Slight	Slight	Severe: silty clay subsoil.	Moderate: moderately slow permeability.	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Severe: silty clay subsoil.	Moderate: moderately slow permeability; slope.	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: silty clay subsoil.	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; silty clay subsoil.	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; silty clay subsoil.	Severe: slope	Moderate: slope; silty clay loam surface layer.
Moderate: loamy sand texture.	Moderate: loamy sand texture.	Severe: loamy sand texture.	Severe: rapid permeability.	Severe: loamy sand texture.	Moderate: loamy sand texture.
Moderate: loamy sand texture; slope.	Moderate: loamy sand texture; slope.	Severe: loamy sand texture.	Severe: rapid permeability.	Severe: loamy sand texture.	Moderate: loamy sand texture.
Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: somewhat poorly drained; silty clay loam subsoil.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank filter fields	Building locations	Campsites	Roads
Licking:				
LkA	Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table; high shrink-swell potential.	Severe: very slow permeability.	Severe: high shrink-swell potential.
LkB	Severe: slow permeability.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Severe: high shrink-swell potential.
LIC	Severe: slow permeability.	Severe: high shrink-swell potential.	Severe: very slow permeability; slope; silty clay loam surface layer.	Severe: high shrink-swell potential.
LID	Severe: slope; slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope; high shrink-swell potential.
LmD3	Severe: slope; slow permeability.	Severe: slope; high shrink-swell potential.	Severe: slope; silty clay surface layer.	Severe: slope; high shrink-swell potential.
Lindside: Ln	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding.
Negley:				
NeB	Slight	Slight	Slight	Moderate: slope
NeC	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope
NeD	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Newark: Nk	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.
Nicholson:				
NIB	Severe: slow permeability.	Moderate: seasonal high water table; moderate shrink-swell potential.	Moderate: slow permeability.	Moderate: seasonal high water table.
NIC	Severe: slow permeability.	Moderate: seasonal high water table; slope; moderate shrink-swell potential.	Moderate: slow permeability; slope.	Moderate: slope; seasonal high water table.
Nolin: No	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.
Robertsville: Ro	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.
Rossmoyne:				
RsB	Severe: slow permeability.	Moderate: seasonal high water table; moderate shrink-swell potential.	Moderate: slow permeability; seasonal high water table.	Moderate: seasonal high water table.
RsC	Severe: slow permeability.	Moderate: seasonal high water table; slope; moderate shrink-swell potential.	Severe: slow permeability; seasonal high water table.	Moderate: slope; seasonal high water table.

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Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Sanitary landfills	Cemeteries	Trails
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe; seasonal high water table; clayey subsoil.	Severe: seasonal high water table; very slow permeability.	Moderate: seasonal high water table.
Moderate: very slow permeability; slope.	Slight	Slight	Moderate: very slow permeability.	Moderate: very slow permeability.	Slight.
Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Severe: clayey subsoil.	Severe: very slow permeability; slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Severe: slope	Severe: slope	Severe: slope	Severe: clayey subsoil.	Severe: slope	Moderate: slope; silty clay loam surface layer.
Severe: slope; silty clay surface layer.	Severe slope; silty clay surface layer.	Severe: slope; silty clay surface layer.	Severe: clayey subsoil.	Severe: slope; silty clay surface layer.	Severe: silty clay surface layer.
Moderate: subject to flooding; seasonal high water table.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Moderate: slope	Slight	Slight	Slight	Slight	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: subject to flooding.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.
Moderate: slow permeability.	Slight	Slight	Moderate: silty clay loam subsoil.	Severe: slow permeability.	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Moderate: silty clay loam subsoil.	Severe: slow permeability.	Slight.
Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.
Moderate: slow permeability; slope.	Slight	Slight	Moderate: silty clay loam subsoil.	Severe: slow permeability.	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Moderate: silty clay loam subsoil.	Severe: slow permeability.	Slight.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank filter fields	Building locations	Campsites	Roads
Wheeling:				
WhA	Slight	Slight	Slight	Slight
WhB	Slight	Slight	Slight	Slight
WhC	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope
Woolper:				
WoC	Severe: moderately slow permeability.	Severe: high shrink-swell potential.	Moderate: moderately slow permeability; slope.	Severe: high shrink-swell potential.
WoD	Severe: slope; moderately slow permeabiltiy.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope; high shrink-swell potential.

SEPTIC TANK FILTER FIELDS.—Ratings for this use are based on soil permeability, depth to seasonal high water table, depth to bedrock, slope, and flooding hazard. Possible pollution of water supply is not considered in making the ratings, because onsite investigation is needed to determine such pollution. Pollution could be a hazard on some soils, such as those of the Lakin series.

BUILDING LOCATIONS.—Buildings considered are dwellings and service buildings of three stories or less that have basements. The ratings for this use are based on depth to the seasonal high water table, depth to bedrock, slope (fig. 10 *top*), flooding hazard, and shrink-swell potential (fig. 10 *bottom*). Slope is more restrictive for subdivision development than for country residences.

CAMPSITES.—Ratings for this intensive use are based on depth to bedrock, permeability, depth to seasonal high water table, surface rockiness and stoniness, texture of the surface soil, and the flooding hazard. Soil limitations for tent sites are generally the same as for trailer parks; however, slope is a more significant feature for trailers.

ROADS.—The roads considered are the hard-surfaced type of the design normally used for county and small town traffic. Requirements for parking lots and streets are similar, but slope is a more significant feature for parking lots. The soil properties considered for these uses are depth to seasonal high water table, slope, depth to rock, surface rockiness or stoniness, shrink-swell potential, and the flooding hazard.

ATHLETIC FIELDS.—This intensive use for team sports, such as baseball, football, and volleyball, normally requires that the finished area be nearly level; it is subject to heavy foot traffic. Soil ratings are based on depth to seasonal high water table, soil permeability, slope, depth to bedrock, surface rockiness or stoniness, surface soil texture, and flooding hazard.

PLAY AND PICNIC AREAS.—These areas are subject to less intensive use than athletic fields. The ratings are based on depth to seasonal high water table, slope, depth to bedrock, surface rockiness or stoniness, texture of the surface soil, and the flooding hazard. These factors are less significant for play areas and picnic areas than for athletic fields.

LAWNS, LANDSCAPING, AND GOLF FAIRWAYS.—For these uses, it is assumed that soil material at the site will be used. No importation of fill or topsoil is considered in the ratings. The ratings are based on depth to seasonal water table, slope, depth to bedrock, surface stoniness or rockiness, texture of the surface soil, and the flooding hazard.

SANITARY LANDFILLS.—The soils are rated in terms of suitability for use as disposal areas for trash and garbage. It is assumed that the disposal operation is the trench method. No importation of fill or cover material is considered in the ratings. The ratings are based on depth to seasonal high water table, permeability, slope, depth to bedrock, surface rockiness or stoniness, surface soil texture, and the flooding hazard. Possible pollution of water supplies is not considered in making the ratings, because onsite investigation is needed to determine such pollution hazard. Pollution could be a severe hazard, however, on some soils, such as those of the Lakin series.

CEMETERIES.—These are community-type cemeteries. It is assumed that soil material at the site will be used. No consideration is given to importation of fill or topsoil in the ratings. The soil factors to consider are depth to seasonal high water table, slope, permeability, depth to bedrock, surface rockiness or stoniness, surface soil texture, and the flooding hazard.

TRAILS.—These are for nonintensive uses, such as cross-country hiking and bridle paths. It is assumed that the

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Athletic fields	Play and picnic areas	Lawns, landscaping, and golf fairways	Sanitary landfills	Cemeteries	Trails
Slight	Slight	Slight	Severe: moderately rapid permeability.	Slight	Slight.
Moderate: slope.	Slight	Slight	Severe: moderately rapid permeability.	Slight	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Severe: moderately rapid permeability.	Moderate: slope	Slight.
Severe: slope	Moderate: slope	Moderate: slope	Severe: clayey subsoil.	Moderate: slope; moderately slow permeability.	Moderate: silty clay loam surface layer.
Severe: slope	Severe: slope	Severe: slope	Severe: clayey subsoil.	Severe: slope	Moderate: slope; silty clay loam surface layer.

areas are used as they occur in nature. The soil features on which the ratings are based are wetness, slope, surface rockiness or stoniness, surface soil texture, and the flooding hazard.

Formation, Morphology, and Classification of the Soils

This section describes the factors of soil formation and their effect on the soils of the survey area, discusses the morphology of the soils and processes of soil formation, and explains the classification of the soils by categories broader than the series.

Factors of Soil Formation

The factors that determine the kind of soil that forms are the climate, the composition of the parent material, the topography, the plant and animal life, and time. Soil is formed by the interaction of these five factors. In some areas one factor may dominate in the formation of soil characteristics, and in other areas another factor may dominate. Climate and plant and animal life, for example, are not likely to vary greatly in an area the size of this survey area, but there may be many local differences in relief and parent material.

Since the interrelationships among the five factors are complex, the effects of any one factor are hard to determine. Some of the ways in which each of these factors has influenced soil formation in Boone, Campbell, and Kenton Counties are discussed in the following paragraphs.

Climate

The climate of Boone, Campbell, and Kenton Counties is temperate and humid. The average annual precipitation is about 40 inches. The soils are almost never dry, and they are subject to leaching throughout most of the year. The average annual air temperature is about 54° F.; the average air temperature in January is about 43° lower than the average temperature in July.

The soils in this survey area that best show the influence of climate have a leached, acid surface layer. They are dark brown, dark yellowish brown, or yellowish brown. They have a subsoil that is finer textured than the surface layer. Examples are soils of the Faywood and Jessup series. The depth of leaching is not great, because the base saturation of many soils is above 35 percent within a depth of 50 inches. Lime nodules, for example, occur within a depth of 50 inches in the Licking soils, yet the upper part of the B horizon is strongly acid.

Parent material

The parent material is the unconsolidated mass from which the soils develop. It formed from the weathering or decomposition of rocks and minerals. In this survey area, the soils formed in calcareous clayey glacial till, in stream alluvium or lacustrine material, and in residential material that weathered from limestone, calcareous shale, and siltstone. The upper layers of some of the soils formed in wind-deposited sandy or silty material.

Soils, such as those of the Jessup series, that formed partly in glacial till and those of the Faywood series, that formed in residual material, are fine textured and have moderately slow permeability in the lower horizons. The soils formed in glacial till are generally deeper to rock than the soils formed in residuum. The Rossmoyne (fig. 11) and Nicholson soils formed in loess in the upper part and in glacial till or residual material in the lower part. They have smooth upper horizons that are high in silt content, but the soils are clayey in the lower horizons. Soils formed in alluvial materials include the

Figure 10.—Top: Retaining walls are needed to prevent slippage on this steep Eden soil. *Bottom:* Retaining wall has cracked because of shrinking and swelling. The soil is Licking silt loam.

gravelly Chagrin soils, the loamy Huntington and Lindside soils, and the sandier Chavies soils. The Licking soils formed in moderately fine textured and fine textured lacustrine sediments.

Topography

The topography, or the position, shape, and slope of the soils on the landscape, influences the formation of soils primarily through its effect on drainage and erosion. It also influences the formation of soils through variations in exposure to sun, wind, air drainage, and plant cover.

On steep soils a considerable amount of water is lost through runoff, and only a small amount of water enters the soil. As a result, erosion is generally active and the soil material is removed almost as rapidly as it is formed. The well-drained to somewhat excessively drained Cynthiana soils have 12 to 50 percent slopes and are shallow.

In nearly level areas, a large amount of water enters the soil and there is little or no erosion. For example, the somewhat poorly drained Lawrence and Avonburg soils and the poorly drained Robertsville soils are nearly level. There is little or no erosion, and the soils have a seasonal high water table.

The Newark soils are somewhat poorly drained and have a seasonal high water table because they occur in low areas in first bottoms where water tends to collect. The soils are accumulating material from soils on uplands in the watershed.

The difference in soils due to variations in topography, such as exposure to the sun, air drainage, and present plant cover, is not enough to cause significant differences in the soil in this survey area.

Plant and animal life

Plants affect soil formation mainly by adding organic matter. Animals, bacteria, and fungi contribute mainly by converting the remains of plants to organic matter. The organic matter imparts a dark color to the soil material and affects the soil structure.

The soils in this area formed under hardwood forest. Hardwood trees allow calcium and other bases to leach from the soil more readily than grasses. In a few remaining undisturbed areas, the A1 horizon of such soils as those of the Nicholson and Rossmoyne series is very dark grayish brown and has moderate, fine, granular structure. The A2 horizon is thin, leached, and light colored and has weak granular structure. The B horizon is brighter colored and generally has moderate, medium, subangular blocky structure.

When the trees were cleared from the soils, the environment of the soils changed. Most of the soils have been limed, seeded to grasses and legumes, and plowed many times since the trees were cut and cleared. Much erosion has occurred since the time of early settlement. Many plow layers consist of mixed surface soil and subsoil material.

Time

The formation of soils requires time for change to take place in the parent material. Some parent materials weather more rapidly than others; as a result, different materials can exhibit different characteristics even though exposed to weathering and soil formation for the same length of time. The soils formed in residual materials have been exposed to weathering for the longest period of time. Such soils are highly dissected by erosion. The glacial till in the counties was left by the retreat of the glaciation. Fresh depositions of sediments are left behind on flood plains each time streams overflow. Soils formed on stable landscapes in the oldest materials generally exhibit the most strongly developed profiles. They are deeply leached and have well-developed horizons. The Rossmoyne soils, for example, are strongly acid to a depth of 50 inches and have evident A, B, and C horizons. They have a well-developed fragipan in the subsoil.

Figure 11.—Road ditch in Rossmoyne soils. The soil on the sides of the ditch formed in loess, and the soil at the bottom of the ditch formed in glacial till.

Morphology of the Soils

The results of the soil-forming factors are reflected in the different layers, or genetic horizons, in a soil. The soil extends from the surface downward to materials that are little altered by soil-forming processes.

Most soils contain three major horizons, designated A, B, and C horizons. These major horizons are subdivided by the use of numbers and letters to indicate differences within one horizon. An example is a B2t horizon, which represents a layer within the B horizon that contains translocated clay from horizons above it.

The A horizon is the surface layer. In some profiles an A1 horizon develops; this horizon contains the largest accumulation of organic matter and is also the layer of maximum leaching or eluviation of clay and iron. If considerable leaching has taken place, an A2 horizon forms.

The B horizon lies beneath the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay or iron leached from the A horizon. The B horizon is generally brighter colored than the A horizon.

The C horizon is below the B horizon and is commonly called parent material. It is not true parent material, however, as it has been modified to some extent by weathering.

Several processes are involved in the formation of soil horizons. These include the accumulation of organic matter, the leaching or accumulation of soluble salts and carbonates, the formation and translocation of clay minerals, and the reduction and transfer of iron and other elements. These processes are taking place in all soils but at different intensities, depending upon the interaction of soil-forming factors.

The accumulation of organic matter takes place with

the decomposition of plant residue. This process darkens the surface layer and helps form the A1 horizon. The soils in the survey area range from very low in organic-matter content in Eden soils to high in organic-matter content in Woolper soils.

It is believed that lime and other soluble salts are leached before the translocation of clay minerals. Many factors affect this leaching, such as the kinds of salts originally present, the depth to which the soils solution percolates, and the texture of the soil. In this survey area, even though the soils formed in calcareous material, soils such as those of the Rossmoyne, Jessup, Nicholson, and Faywood series are acid because of leaching. The soils on first bottoms are only slightly acid or mildly alkaline because of recent additions and lack of leaching.

The most important process of horizon development in this survey area is the formation and translocation of clay minerals. The amount of clay minerals in a soil profile is determined by the kind of parent material, but the amount of clay varies from one horizon to another. Clay minerals are generally moved from the A horizon and deposited in the B horizon as indicated by clay films on ped faces and in pores and root channels. Most of the leached A2 horizons in the survey area have been destroyed by plowing or removed by erosion, but clay films are common on peds in many of the B horizons in the soils of this area.

The reduction and transfer of iron is associated mainly with the somewhat poorly drained or poorly drained soils in the area. This process is called gleying. Evidence of this process is the presence of iron or manganese concretions and the dominant gray colors below the A horizon. Soils of the Robertsville, Avonburg, and Newark series in the survey area show evidence of gleying.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships (*6*). Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*14*). The system currently used by the National Cooperative Soil Survey was adopted in 1965 (*16*). It is under continual study. In table 8 the classification of soils is given as of November 1970.

The current system of classification has six categories (*13*). Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Some of the soils in this survey do not fit in a series that has been recognized in the classification system, but recognition of a separate series would not serve a useful purpose. Such soils differ from those series in ways too small to be of consequence in interpreting their usefulness or behavior. Soil scientists designate such soils as taxadjuncts to the series for which they are named. In this survey, soils named in the Ashton, Brashear, Chagrin, Egam, Huntington, Lakin, and Lindside series are taxadjuncts to those series.

ORDER.—The criteria selected for differentiating soil orders tends to produce climatic grouping of soils. An exception to this is the Entisols order, which can be found in almost any climate. Ten soil orders are recognized in the current system. As shown in table 8, five orders are represented in this survey area. These are the Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols.

Entisols are recent soils in which there has been no horizon development other than a horizon of organic-matter accumulation.

Inceptisols are moist soils that have weakly expressed horizons. They lack horizons of clay accumulation.

Mollisols are soils that have a dark-colored surface layer, 10 inches or more thick, that has a base saturation of 50 percent or more.

Alfisols are soils that have a clay-enriched B horizon and 35 percent or more base saturation within a depth of 50 inches or within 30 inches below the upper boundary of a fragipan.

Ultisols are similar to Alfisols except that they have less than 35 percent base saturation within the depths specified.

SUBORDER.—Each order is divided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the order. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP.—Soil suborders are divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 8, because it is the last word in the name of the subgroup.

SUBGROUP.—Great groups are subdivided into subgroups; one representing the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILY.—Families are established within a subgroup primarily on the basis of properties important to plant growth. Some of the properties considered are texture,

TABLE 8.—*Classification of soil series by higher categories*

Series	Current classification			Great soil group (1938 classification)
	Family	Subgroup	Order	
Ashton [1]	Fine-silty, mixed, mesic	Mollic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Alluvial soils.
Avonburg	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Planosols.
Boonesboro	Fine-loamy, mixed, mesic	Fluventic Hapludolls	Mollisols	Alluvial soils.
Brashear [2]	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Captina	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils that have a fragipan.
Chagrin [3]	Fine-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Chavies	Coarse-loamy, mixed, mesic.	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Alluvial soils.
Cynthiana	Clayey, mixed, mesic	Lithic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Lithosols.
Eden	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Lithosols.
Egam [4]	Fine, mixed, thermic	Cumulic Hapludolls	Mollisols	Alluvial soils.
Faywood	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Huntington [5]	Fine-silty, mixed, mesic	Fluventic Hapludolls	Mollisols	Alluvial soils.
Jessup	Fine, illitic, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Lakin [6]	Mixed, mesic	Alfic Udipsamments	Entisols	Regosols.
Lawrence	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols	Planosols.
Licking	Fine, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Lindside [7]	Fine-silty, mixed, mesic	Fluvaquentic Eutrochrepts.	Inceptisols	Alluvial soils.
Negley	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Newark	Fine-silty, mixed, nonacid mesic.	Aeric Fluvaquents	Entisols	Alluvial soils intergrading to Low-Humic Gley soils.
Nicholson	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils that have a fragipan.
Nolin	Fine-silty, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Robertsville	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Ultisols	Planosols.
Rossmoyne	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols	Planosols.
Wheeling	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Woolper	Fine, mixed, mesic	Typic Argiudolls	Mollisols	Gray-Brown Podzolic soils.

[1] The Ashton soils have a thinner solum than the defined range for this series. They are taxadjuncts to the Ashton series.

[2] The Brashear soils have a thicker solum than the defined range for the series. They are taxadjuncts to the Brashear series.

[3] The Chagrin soils have a finer textured A horizon and are more alkaline than the defined range for the series. They are taxadjuncts to the Chagrin series.

[4] The Egam soils have a lower temperature than the defined range for the series. They are taxadjuncts to the Egam series.

[5] The Huntington soils are sandier throughout the solum than the defined range for the series. They are taxadjuncts to the Huntington series.

[6] The Lakin soils have a darker colored Ap horizon than the defined range for the series. They are taxadjuncts to the Lakin series.

[7] The Lindside soils in this survey area are more alkaline than the defined range for the series. They are taxadjuncts to the Lindside series.

mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

SERIES.—The series consists of a group of soils that formed in a particular kind of parent material and have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

General Nature of the Area

This section gives general facts about Boone, Campbell, and Kenton Counties. It briefly discusses climate, history and development, physiography, and farming.

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Climate [8]

The climate of Boone, Campbell, and Kenton Counties is temperate and humid. The average temperature for January is about 33° F. For July it is about 76°, and for the year it is about 54°. Average rainfall is about 40 inches per year. There are no regular wet or dry seasons; precipitation is fairly well distributed throughout the year. Although droughty conditions occur, rains generally prevent complete crop failures. The climate is favorable for many kinds of plants and animals.

In this survey area, temperature and precipitation decrease noticeably from south to north. In table 9 this is indicated by data from a location just south of the

[8] By A. B. ELAM, JR., climatologist for Kentucky, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation*

[Extremes of average daily temperature and average monthly precipitation data from a southern station at Williamstown and a northern station at Covington. Other data estimated for a central location. For period 1931–1960]

Month	Temperature						Precipitation					
	Average daily maximum		Average daily minimum		Average monthly maximum	Average monthly minimum	Average total		One year in ten will have—		Days with 1 inch or more of snow on the ground	Average depth of snow on days with snow cover
	South	North	South	North			South	North	Less than—	More than—		
	°F.	°F.	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*		*Inches*
January	43	41	25	23	64	3	4.1	3.6	1.2	6.9	7	3
February	46	43	26	24	66	5	3.4	2.9	1.0	5.5	4	3
March	54	51	32	30	75	15	4.6	3.8	1.5	7.8	2	3
April	67	64	43	41	85	27	4.0	3.2	1.6	5.7	(1)	1
May	77	74	53	51	89	37	4.0	3.6	1.6	6.5	0	0
June	85	84	62	60	95	49	4.3	3.9	1.6	7.4	0	0
July	89	87	66	63	97	55	4.0	3.6	1.7	6.5	0	0
August	87	86	64	62	97	53	3.2	2.6	1.5	5.9	0	0
September	82	80	57	55	95	42	3.1	2.8	1.0	4.9	0	0
October	70	68	46	44	85	30	2.4	2.3	.8	4.0	0	0
November	55	53	35	33	76	16	3.3	3.0	1.0	5.6	1	3
December	44	42	27	25	64	6	3.0	2.8	1.3	4.3	5	2
Year	67	64	45	43	[2] 99	[3] −3	43.3	38.0	29.9	48.4	19	3

[1] Less than half a day.
[2] Average annual maximum.
[3] Average annual minimum.

border at Williamstown and from a location at the extreme northern edge of the survey area at the Covington office of the National Weather Service at the Greater Cincinnati Airport.

In this survy area, the average length of the growing season from the last freezing temperature in the spring to the first in fall is about 186 days. Table 10 shows the probabilities of last freezing temperatures in spring and the first in fall.

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data based on readings from thermometers in standard National Weather Service shelters at a height of approximately 5 feet above ground. Lower temperatures occur at times nearer the ground and in local areas that are subject to extreme air drainage]

Probability	Dates for given probability and temperature		
	24° F. or lower	28° F. or lower	32° F. or lower
Spring:			
1 year in 10 later than.	April 12	April 23	May 5
2 years in 10 later than.	April 6	April 17	April 30
5 years in 10 later than.	March 25	April 6	April 20
Fall:			
1 year in 10 earlier than.	October 29	October 19	October 8
2 years in 10 earlier than.	November 4	October 25	October 13
5 years in 10 earlier than.	November 14	November 3	October 23

Thunderstorms occur on an average of about 50 days a year. They are more frequent from March through August but may occur in any month. Most of the brief, high-intensity rains occur in summer during thunderstorms. Less intensive rains that last for several days sometimes occur in spring and cause tillage to be delayed. The prolonged rains are the ones most likely to cause flooding, because they occur when the soils are frozen, snow covered, or saturated. Long periods of mild, sunny weather are typical of the fall harvest season.

The climate of Boone, Campbell, and Kenton Counties is favorable for the growth of corn, tobacco, fall seeded small grains, soybeans, many kinds of grasses and legumes, and many kinds of fruits and vegetables. Generally, moisture conditions in spring are favorable for the preparation of the seedbed and for germination of seed, although germination is retarded in some fall seasons because the soil is dry.

Physiography

Boone, Campbell, and Kenton Counties are the three most northern counties in Kentucky. They are a part of the Bluegrass Region and are underlain by rocks of Ordovician geologic age (*9*).

Roughly half of the area is in the Hills of the Bluegrass and the other half, or the more nearly level part, is in the Outer Bluegrass. The Hills of the Bluegrass are rather steep areas of dominantly Eden soils. The soils are underlain by thin beds of limestone and calcareous shale of the Eden Formation. The Outer Bluegrass area is mostly rolling to undulating. Nicholson and Faywood

soils are dominant in the southern part, and Rossmoyne and Jessup soils are dominant in the northern part. The Nicholson and Faywood soils formed mostly in residual material that weathered from limestone and calcareous shale. The Nicholson soils formed partly in loess. The Rossmoyne and Jessup soils formed in glacial till and a thin loess cap.

The soils along the Ohio River are generally loamy or sandy and better drained than the soils along the Licking River and the small creeks. Many soils along the Licking River, small creeks, and an area in central Campbell County formed in slack water, fine-textured sediments.

History and Development

Campbell County was organized in 1794. It originally included the area that is now Pendleton, Boone, and Kenton Counties and part of Grant County. In 1798 Boone County was established as a separate county, and in 1840 Kenton County was established.

In 1960 Boone County had a population of 21,940; Campbell County, 86,803; and Kenton County, 120,700. The northern part of these counties is in the Greater Cincinnati Metropolitan Area.

The larger towns in the survey area are across the Ohio River from Cincinnati, Ohio. Heavy population growth in the Ohio River Valley is spreading south in the general direction of U. S. Highway No. 25 in Kenton and Boone Counties and along U. S. Highway No. 27 in Campbell County. There are many small towns along the Ohio River and a few small towns along the Licking River.

A large part of Boone, Campbell, and Kenton Counties is urban. There has been a large expansion of housing and industrial development in recent years. Many people work in Ohio but live in these three counties of Kentucky. There are two Interstate Highways, I–75 and I–71, through this area, and most of the county roads are blacktopped. There is considerable boat transportation on the Ohio River, and there are three main railroad lines. The Greater Cincinnati Airport is located in the northern part of Boone County.

Farming

According to the 1964 Census of Agriculture, 71.6 percent of Boone County, 55.8 percent of Campbell County, and 57.7 percent of Kenton County were in farms. There were 1,263 farms in Boone County, 652 farms in Campbell County, and 796 farms in Kenton County. An average farm was about 83 acres in size.

Tobacco is the main cash crop, but the total acreage is small. Only about 10,000 acres of corn was grown in 1964. This is about 6,000 acres less than was grown in 1959. There are about 300 dairy farms in the three counties, about 30 vegetable farms, and a few fruit orchards.

Most of the farming is done by part-time farmers who work full time in Cincinnati. Some farming is done by retired city workers who have recently moved to the country. The trend of part-time farming is increasing, and the number of farms that have less than 10 acres is increasing. Many farms are being sold for housing developments, and the price of land near urban areas is much too high for general farming. Much more land will likely be converted from farming to urban use in the future.

Literature Cited

(1) American Association of State Highway Officials.
1961. Standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2 v., illus.

(2) Baldwin, Mark, Kellogg, Charles E., and Thorp, James.
1938. Soil classification. U.S. Dept. Agr. Ybk: 979-1001, illus.

(3) Beck, Donald E.
1962. Yellow-poplar site index curves. U.S. Dept. Agr. Forest Serv., Southeastern Forest Expt. Sta., Res. Note No. 80, 2 pp. illus.

(4) Broadfoot, W. M.
1960. Yield guide for evaluating cottonwood sites. U.S. Dept. Agr. Forest Serv., Southern Forest Expt. Sta., Occas. Paper 178, 6 pp., illus.

(5) ——— and Krinard, R. M.
1959. Guide for evaluating sweetgum sites. U.S. Dept. Agr. Forest Serv., Southern Forest Expt. Sta., Occas. Paper 176, 8 pp., illus.

(6) Cline, Marlin G.
1949. Basic principles of soil classification. Soil Sci. 67: 81-91.

(7) Coile, T.S. and Schumacher, F. X.
1953. Site index of young stands of loblolly and shortleaf pines in the piedmont plateau region. Jour. of Forestry, 51: 432-435.

(8) McCarthy, E. F.
1933. Yellow-poplar characteristics, growth and management. U.S. Dept. of Agr. Tech. Bull. No. 365, 58 pp., illus.

(9) McFarlan, Arthur C.
1961. Geology of Kentucky. The University of Kentucky, Lexington, 531 pp., illus.

(10) Portland Cement Association.
1962. PCA soil primer. 52 pp., illus.

(11) Putnam, John A., Furnival, George M., and McKnight, J. S.
1960. Management and inventory of southern hardwoods. U.S. Dept. of Agr. Handbook 181, 102 pp., illus.

(12) Schnur, G. Luther
1937. Reprinted 1961. Yield, stand, and volume tables for even-aged upland oak forests. U.S. Dept. Agr., Tech. Bul. 560, 88 pp., illus.

(13) Simonson, Roy W.
1962. Soil classification in the united states. Sci. 137: 1027–1034, illus.

(14) Thorp, James and Smith, Guy D.
1949. Higher categories of soil classification; order, suborder, and great soil groups. Soil Sci. 67: 117-126.

(15) United States Department of Agriculture
1951. Soil survey manual. U.S. Dept. Agr. Handbook No. 18. 503 pp., illus., with 1962 supplement.

(16) ———
1960. Soil classification. a comprehensive system. 7th approximation. 265 pp., illus. [Supplements issued in March 1967 and Sept. 1968]

(17) United States Department of Defense.
1968. Unified soil classification system for roads, airfields, embankments and foundations. MIL-STD-619B, 30 pp., illus.

Glossary

Aggregate (soil structure). Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Available moisture capacity. The difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point. Relative adjective terms used in the text are *high*, *moderate*, *low*, and *very low*.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate; it indicates deposition and movement of clay.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure, but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Fertility, soil. The quality that enables a soil to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition (or tilth) of the soil, are favorable. Terms used to describe fertility are *high*, *moderately high*, *moderate*, and *low*.

Flaggy. A term used to describe a soil that contains relatively thin fragments of limestone 6 to 15 inches long. A single piece is a flagstone.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A dense, brittle subsurface horizon, very low in content of organic matter and clay, but rich in silt or very fine sand. The layer seems to be cemented when it is dry, is hard or very hard, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they occur at depths beginning at 12 to 30 inches below the surface.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are these: fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and coarse, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural drainage. Moisture conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free of mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.

Somewhat poorly drained soils are wet for significant periods, but not all the time. They have a uniform color in the upper part of the A horizon and are mottled in the lower part of the A horizon, at a depth below 6 to 16 inches, and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be lacking or nearly so in some soils.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction, because it is neither acid nor alkaline. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.2 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is a material in which a soil forms.

Rooting zone. The part of the soil that is favorable for growth by plant roots. Terms used to indicate the depth of the root zone are as follows: Very shallow, less than 10 inches; shallow, 10 to 20 inches; moderately deep, 20 to 36 inches; deep, 36 inches or more.

Sand. As a soil separate, individual rock or mineral fragments ranging from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Soil depth. Soil depth in this survey refers to the depth from the surface of the soil to bedrock or other non-soil material. The relative terms are: *deep*, more than 40 inches; *moderately deep*, 20 to 40 inches; and *shallow*, less than 20 inches.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grain (each grain by itself, as in dune sand) or massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Terrace (geological). An old alluvial plain, ordinarily flat or undulating bordering a river, a lake, or the sea. Stream terraces are frequently classed second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are as follows: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam,

clay loam, silty clay loam, sandy clay, silty clay and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth implies friability, high noncapillary porosity, and stable granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geological). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

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SOIL ASSOCIATIONS

1 — Eden-Cynthiana association: Dominantly steep to very steep soils that have a clayey subsoil; on limestone and shale uplands

2 — Faywood-Nicholson association: Dominantly gently sloping to moderately steep soils that have a loamy to clayey subsoil; on ridgetops and side slopes of the limestone and shale uplands

3 — Rossmoyne-Jessup association: Nearly level to moderately steep soils that have a loamy to clayey subsoil; on ridgetops and side slopes of the glaciated uplands

4 — Licking-Captina association: Dominantly gently sloping to moderately steep soils that have a clayey to loamy subsoil; on stream terraces

5 — Wheeling-Huntington-Alluvial land, steep association: Dominantly nearly level and gently sloping soils that have a loamy subsoil; on stream terraces, first bottoms, and moderately steep to steep areas of variable textured alluvium

Compiled 1971

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

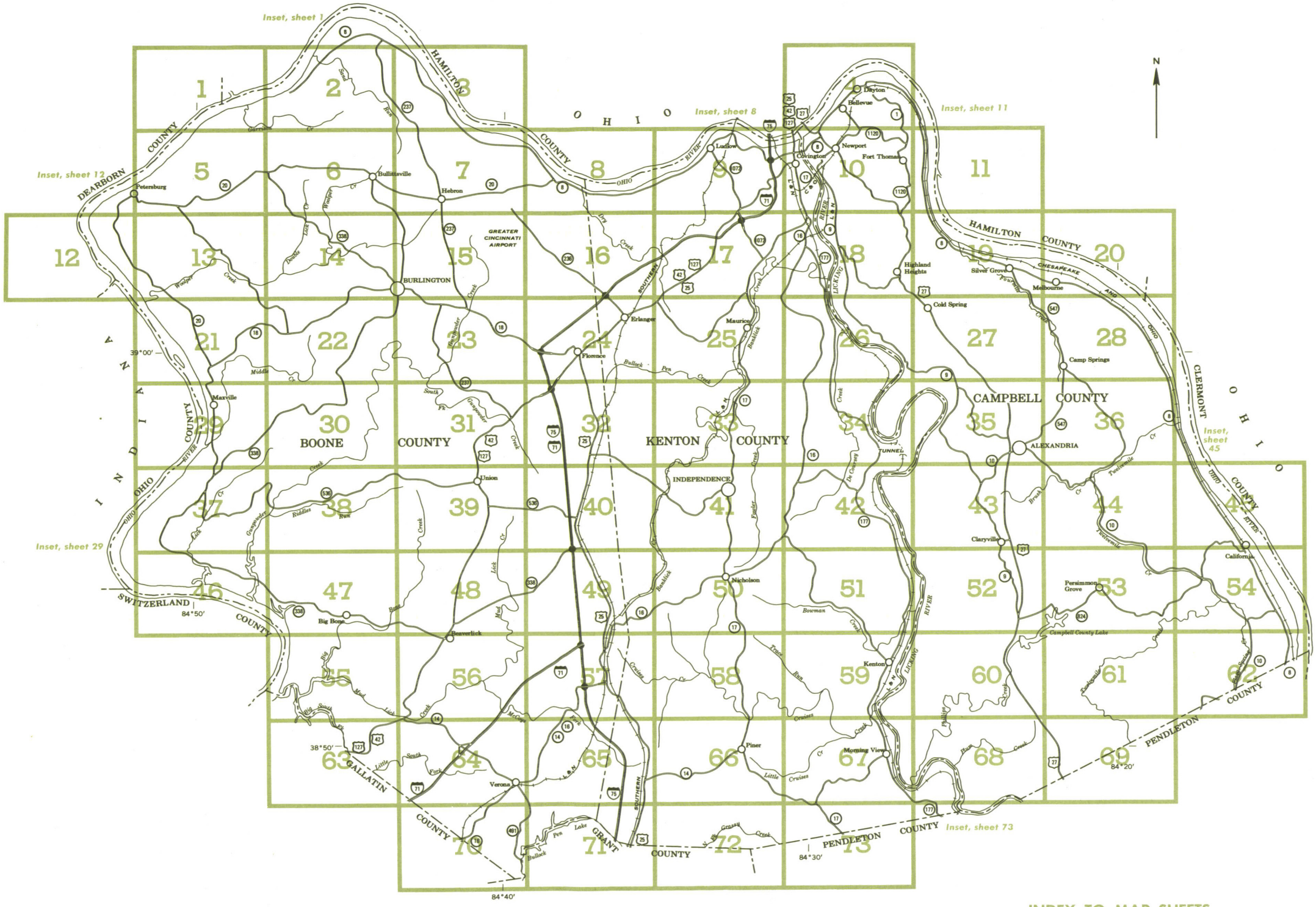
KENTUCKY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY

Scale 1:126,720

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY

Scale 1:190 080

1 0 1 2 3 4 Miles

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Short steep slope

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2 or 3, in the symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
AlD	Alluvial land, steep
AsA	Ashton silt loam, 0 to 2 percent slopes
AsB	Ashton silt loam, 2 to 6 percent slopes
Av	Avonburg silt loam
Bo	Boonesboro silt loam
BrC	Brashear silty clay loam, 6 to 12 percent slopes
BrD	Brashear silty clay loam, 12 to 20 percent slopes
BsD3	Brashear silty clay, 12 to 20 percent slopes, severely eroded
CaB	Captina silt loam, 2 to 6 percent slopes
CaC	Captina silt loam, 6 to 12 percent slopes
Cg	Chagrin gravelly silty clay loam
ChB	Chavies fine sandy loam, 0 to 6 percent slopes
ChC	Chavies fine sandy loam, 6 to 12 percent slopes
CyD	Cynthiana flaggy silty clay loam, 12 to 20 percent slopes
CyF	Cynthiana flaggy silty clay loam, 20 to 50 percent slopes
EdD2	Eden silty clay loam, 12 to 20 percent slopes, eroded
EdE2	Eden silty clay loam, 20 to 35 percent slopes, eroded
Eg	Egam silty clay loam
FaB	Faywood silt loam, 2 to 6 percent slopes
FcC	Faywood silty clay loam, 6 to 12 percent slopes
FcD	Faywood silty clay loam, 12 to 20 percent slopes
FdD3	Faywood silty clay, 12 to 20 percent slopes, severely eroded
Gu	Gullied land
Hn	Huntington fine sandy loam
Hu	Huntington silt loam
JeB	Jessup silt loam, 2 to 6 percent slopes
JeC	Jessup silt loam, 6 to 12 percent slopes
JeD	Jessup silt loam, 12 to 20 percent slopes
JeE	Jessup silt loam, 20 to 30 percent slopes
JsD3	Jessup silty clay loam, 12 to 20 percent slopes, severely eroded
LaA	Lakin loamy fine sand, 0 to 2 percent slopes
LaC	Lakin loamy fine sand, 2 to 12 percent slopes
Lc	Lawrence silt loam
LkA	Licking silt loam, 0 to 2 percent slopes
LkB	Licking silt loam, 2 to 6 percent slopes
LlC	Licking silty clay loam, 6 to 12 percent slopes
LlD	Licking silty clay loam, 12 to 20 percent slopes
LmD3	Licking silty clay, 12 to 20 percent slopes, severely eroded
Ln	Lindside silt loam
NeB	Negley silt loam, 2 to 6 percent slopes
NeC	Negley silt loam, 6 to 12 percent slopes
NeD	Negley silt loam, 12 to 20 percent slopes
Nk	Newark silt loam
NlB	Nicholson silt loam, 0 to 6 percent slopes
NlC	Nicholson silt loam, 6 to 12 percent slopes
No	Nolin silt loam
Ro	Robertsville silt loam
RsB	Rossmoyne silt loam, 0 to 6 percent slopes
RsC	Rossmoyne silt loam, 6 to 12 percent slopes
Ur	Urban land
WhA	Wheeling silt loam, 0 to 2 percent slopes
WhB	Wheeling silt loam, 2 to 6 percent slopes
WhC	Wheeling silt loam, 6 to 12 percent slopes
WoC	Woolper silty clay loam, 6 to 12 percent slopes
WoD	Woolper silty clay loam, 12 to 20 percent slopes

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or woodland suitability group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Estimated yields, table 2, page 31.
Wildlife, table 3, page 36.

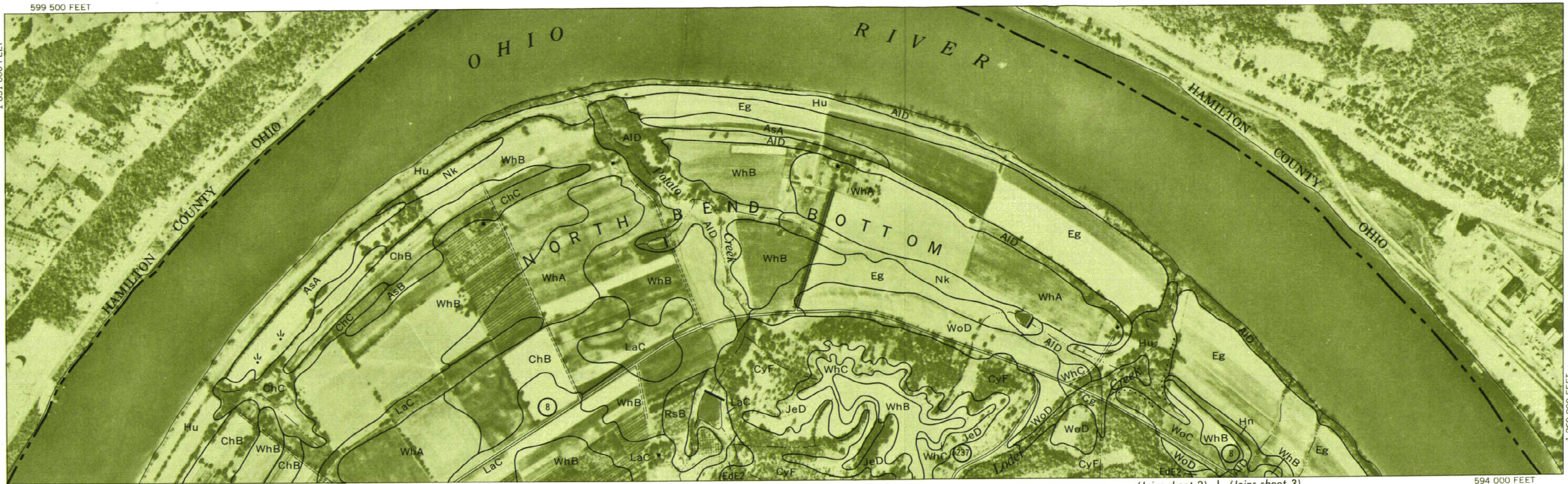
Engineering uses of the soils, tables 4, 5, and 6, pages 40 through 49.
Limitations of soils for nonfarm uses, table 7, page 52.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
AlD	Alluvial land, steep	6	------	--	8	36
AsA	Ashton silt loam, 0 to 2 percent slopes	8	I-2	28	1	34
AsB	Ashton silt loam, 2 to 6 percent slopes	8	IIe-1	28	1	34
Av	Avonburg silt loam	8	IIIw-1	29	3	34
Bo	Boonesboro silt loam	9	Vw-1	30	2	34
BrC	Brashear silty clay loam, 6 to 12 percent slopes	10	IIIe-2	29	6	35
BrD	Brashear silty clay loam, 12 to 20 percent slopes	10	IVe-1	30	6	35
BsD3	Brashear silty clay, 12 to 20 percent slopes, severely eroded	10	VIe-1	30	7	35
CaB	Captina silt loam, 2 to 6 percent slopes	11	IIe-3	28	4	35
CaC	Captina silt loam, 6 to 12 percent slopes	11	IIIe-3	29	4	35
Cg	Chagrin gravelly silty clay loam	11	IIs-1	28	2	34
ChB	Chavies fine sandy loam, 0 to 6 percent slopes	12	IIe-1	28	1	34
ChC	Chavies fine sandy loam, 6 to 12 percent slopes	12	IIIe-1	29	1	34
CyD	Cynthiana flaggy silty clay loam, 12 to 20 percent slopes	13	VIe-1	30	7	35
CyF	Cynthiana flaggy silty clay loam, 20 to 50 percent slopes	13	VIIe-1	30	7	35
EdD2	Eden silty clay loam, 12 to 20 percent slopes, eroded	13	VIe-1	30	7	35
EdE2	Eden silty clay loam, 20 to 35 percent slopes, eroded	13	VIe-1	30	7	35
Eg	Egam silty clay loam	15	IIs-1	28	2	34
FaB	Faywood silt loam, 2 to 6 percent slopes	15	IIe-2	28	6	35
FcC	Faywood silty clay loam, 6 to 12 percent slopes	15	IIIe-2	29	6	35
FcD	Faywood silty clay loam, 12 to 20 percent slopes	15	IVe-1	30	6	35
FdD3	Faywood silty clay, 12 to 20 percent slopes, severely eroded	16	VIe-1	30	7	35
Gu	Gullied land	16	VIIe-2	31	8	36
Hn	Huntington fine sandy loam	16	I-1	27	2	34
Hu	Huntington silt loam	16	I-1	27	2	34
JeB	Jessup silt loam, 2 to 6 percent slopes	17	IIe-2	28	6	35
JeC	Jessup silt loam, 6 to 12 percent slopes	17	IIIe-2	29	6	35
JeD	Jessup silt loam, 12 to 20 percent slopes	17	IVe-1	30	6	35
JeE	Jessup silt loam, 20 to 30 percent slopes	17	VIe-1	30	6	35
JsD3	Jessup silty clay loam, 12 to 20 percent slopes, severely eroded	18	VIe-1	30	7	35
LaA	Lakin loamy fine sand, 0 to 2 percent slopes	18	IIIs-1	29	5	35
LaC	Lakin loamy fine sand, 2 to 12 percent slopes	18	IIIs-1	29	5	35
Lc	Lawrence silt loam	19	IIIw-1	29	3	34
LkA	Licking silt loam, 0 to 2 percent slopes	19	IIIw-1	29	3	34
LkB	Licking silt loam, 2 to 6 percent slopes	19	IIe-2	28	6	35
LlC	Licking silty clay loam, 6 to 12 percent slopes	20	IIIe-2	29	6	35
LlD	Licking silty clay loam, 12 to 20 percent slopes	20	IVe-1	30	6	35
LmD3	Licking silty clay, 12 to 20 percent slopes, severely eroded	20	VIe-1	30	7	35
Ln	Lindside silt loam	20	I-1	27	2	34
NeB	Negley silt loam, 2 to 6 percent slopes	21	IIe-1	28	1	34
NeC	Negley silt loam, 6 to 12 percent slopes	21	IIIe-1	29	1	34
NeD	Negley silt loam, 12 to 20 percent slopes	21	IVe-1	30	1	34
Nk	Newark silt loam	22	IIw-1	28	3	34
NlB	Nicholson silt loam, 0 to 6 percent slopes	22	IIe-3	28	4	35
NlC	Nicholson silt loam, 6 to 12 percent slopes	23	IIIe-3	29	4	35
No	Nolin silt loam	23	I-1	27	2	34
Ro	Robertsville silt loam	24	IVw-1	30	3	34
RsB	Rossmoyne silt loam, 0 to 6 percent slopes	24	IIe-3	28	4	35
RsC	Rossmoyne silt loam, 6 to 12 percent slopes	24	IIIe-3	29	4	35
Ur	Urban land	25	-------	--	8	36
WhA	Wheeling silt loam, 0 to 2 percent slopes	25	I-2	28	1	34
WhB	Wheeling silt loam, 2 to 6 percent slopes	25	IIe-1	28	1	34
WhC	Wheeling silt loam, 6 to 12 percent slopes	25	IIIe-1	29	1	34
WoC	Woolper silty clay loam, 6 to 12 percent slopes	26	IIIe-2	29	6	35
WoD	Woolper silty clay loam, 12 to 20 percent slopes	26	IVe-1	30	6	35

461-778 O - 73 (Face O.P. maps) No. 1

①

N



(Joins sheet 2) | (Joins sheet 3)

(Joins sheet 2)

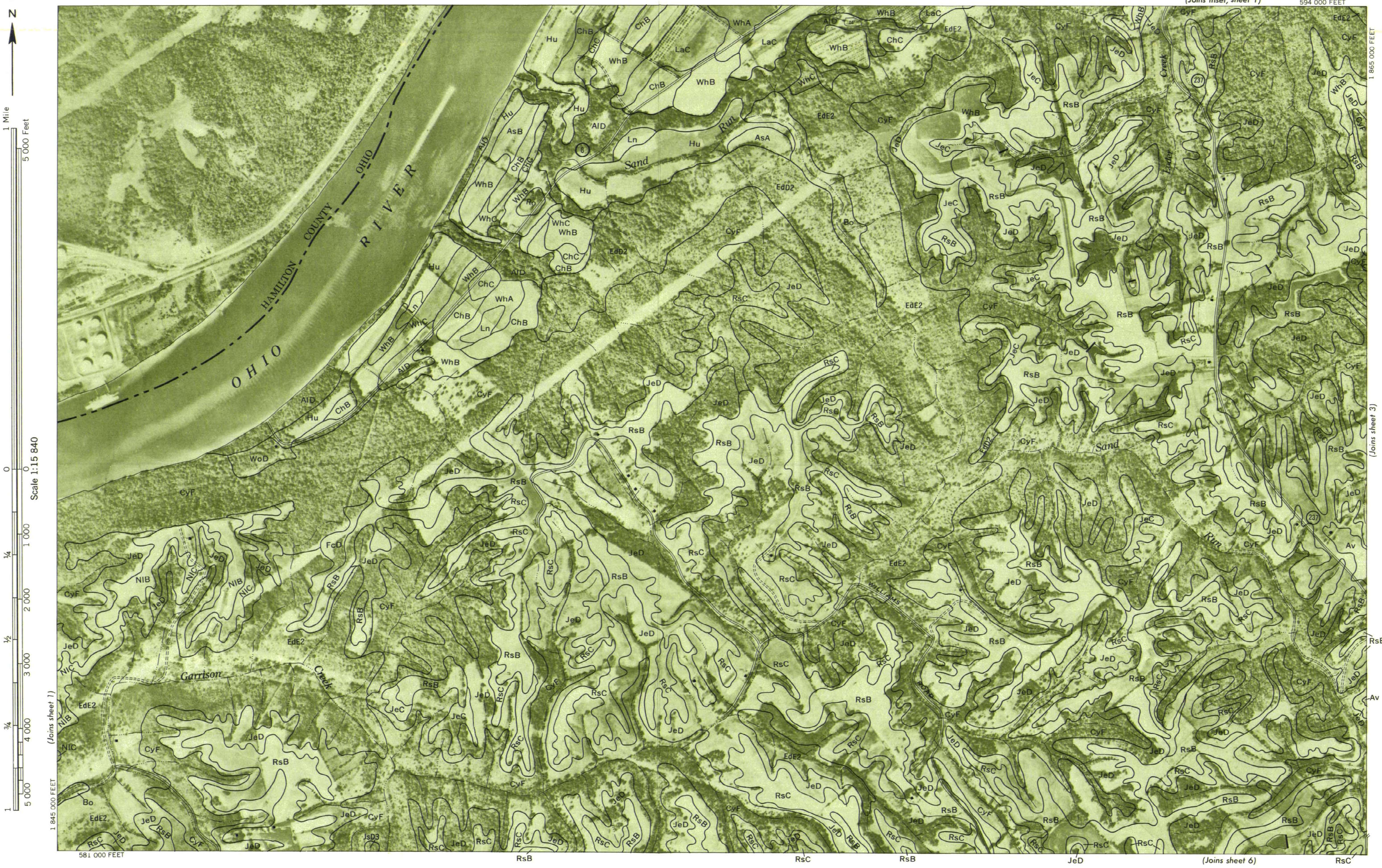
(Joins sheet 5)

1 Mile
5 000 Feet
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000
Scale 1:15 840

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 1

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 2



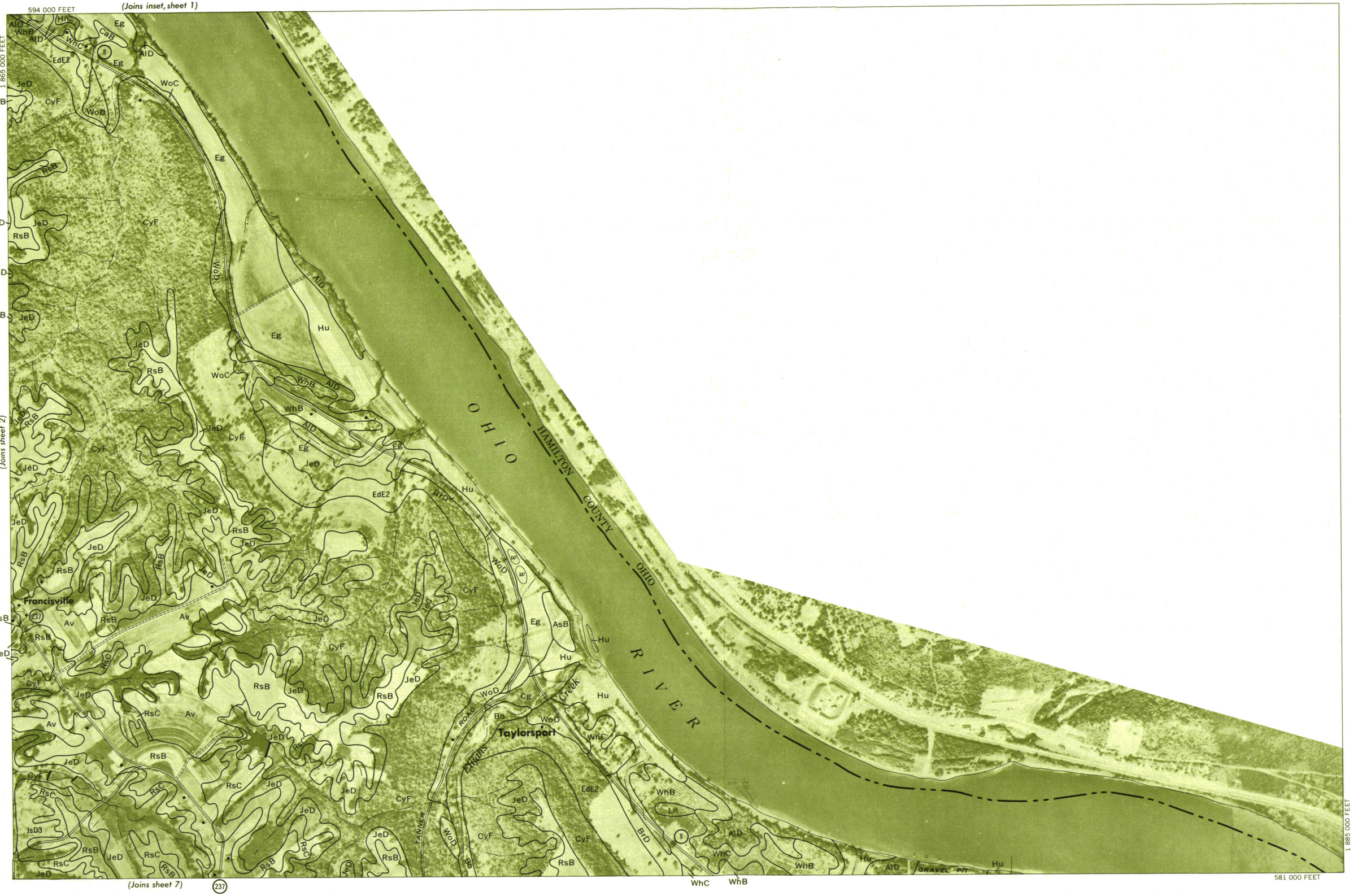
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 2

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 3

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



N

1 Mile
5 000 Feet
Scale 1:15 840

4

N

1 Mile

5 000 Feet

Scale 1:15 840

1 0 0 5 000 ¾ 4 000 ½ 3 000 ¼ 2 000 0 1 000

594 000 FEET

1 945 000 FEET

1 925 000 FEET

581 000 FEET

HAMILTON COUNTY OHIO

RIVER

OHIO

DAYTON

BELLEVUE

TAYLOR MILL

CHESAPEAKE AND OHIO

Ur

Hu

LaA

AlD

UF

WhB

LaC

EdE2

FcD

NeB

FcC

NeC

EdD2

LlC

NlB

(Joins inset, sheet 11)

(Joins sheet 10)

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 4

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 5

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

581 000 FEET

1 825 000 FEET

(Joins sheet 1)

N

1 Mile

5 000 Feet

Scale 1:15 840

OHIO RIVER

DEARBORN COUNTY INDIANA

Second Creek

Bo Creek

Lake Jeanctia

Taylor Creek

Ashbys Fork Road

Stevens Road

Petersburg

SAND AND GRAVEL PIT

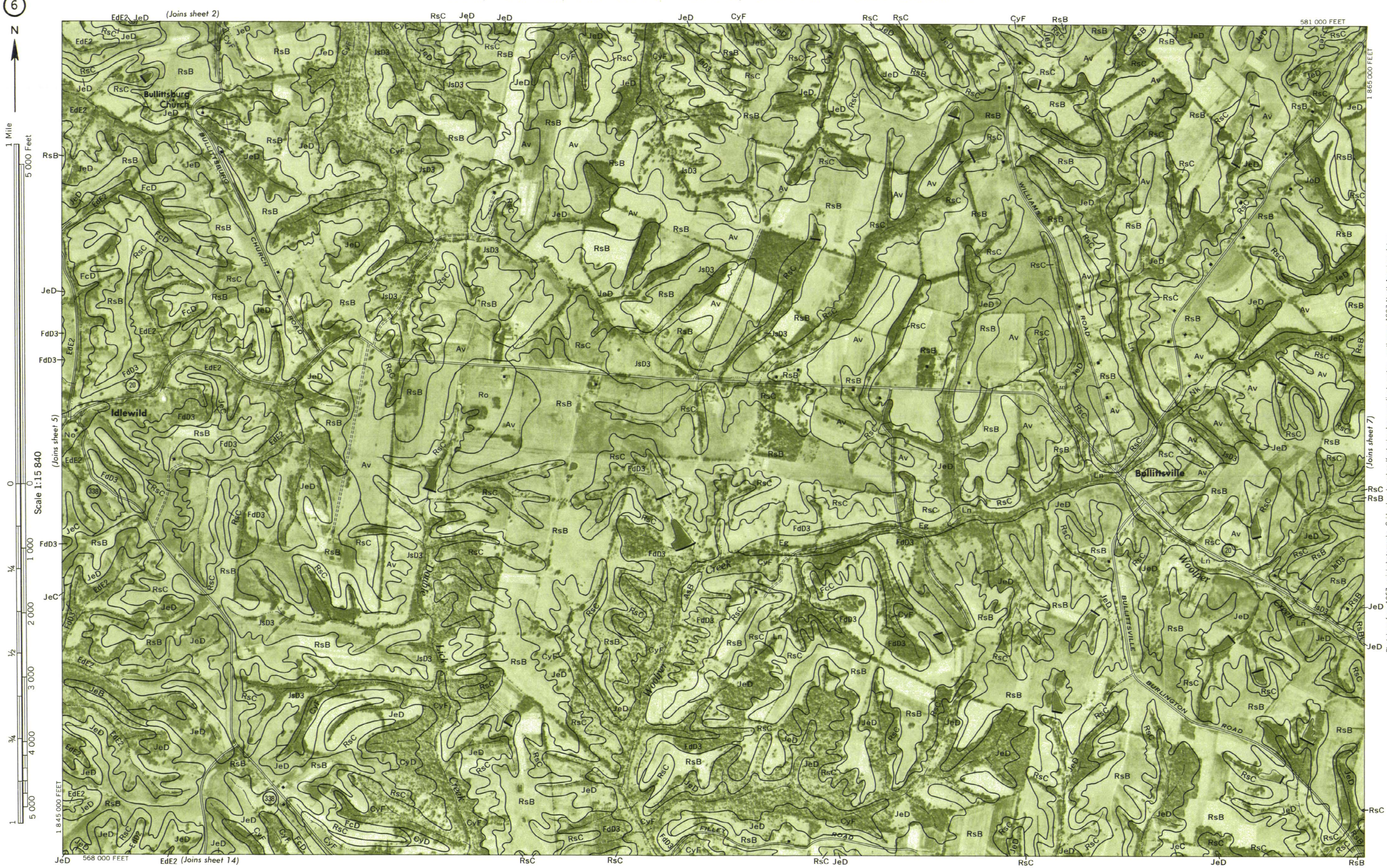
(Joins inset, sheet 12)

(Joins sheet 6)

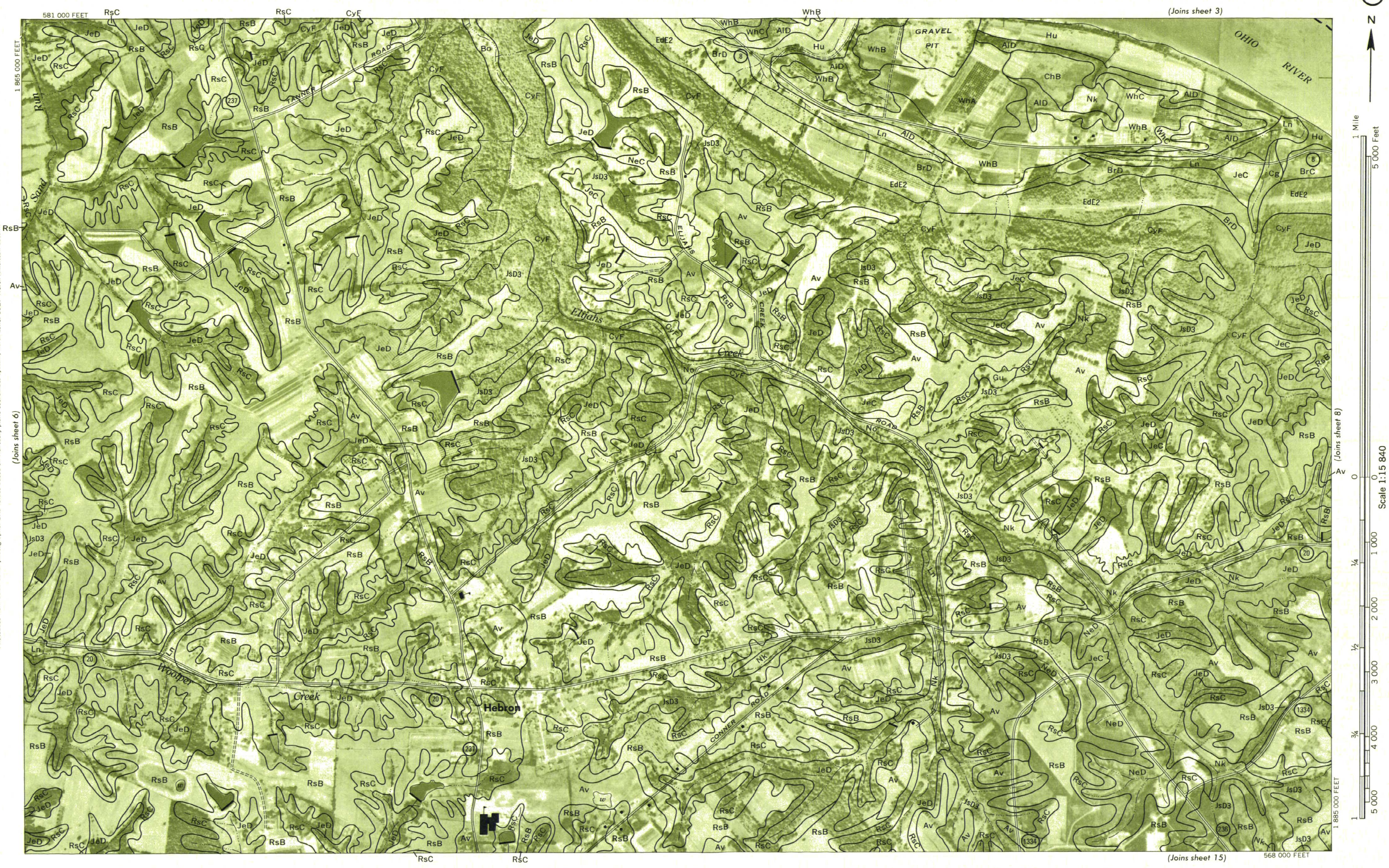
(Joins sheet 13)

568 000 FEET

1 845 000 FEET

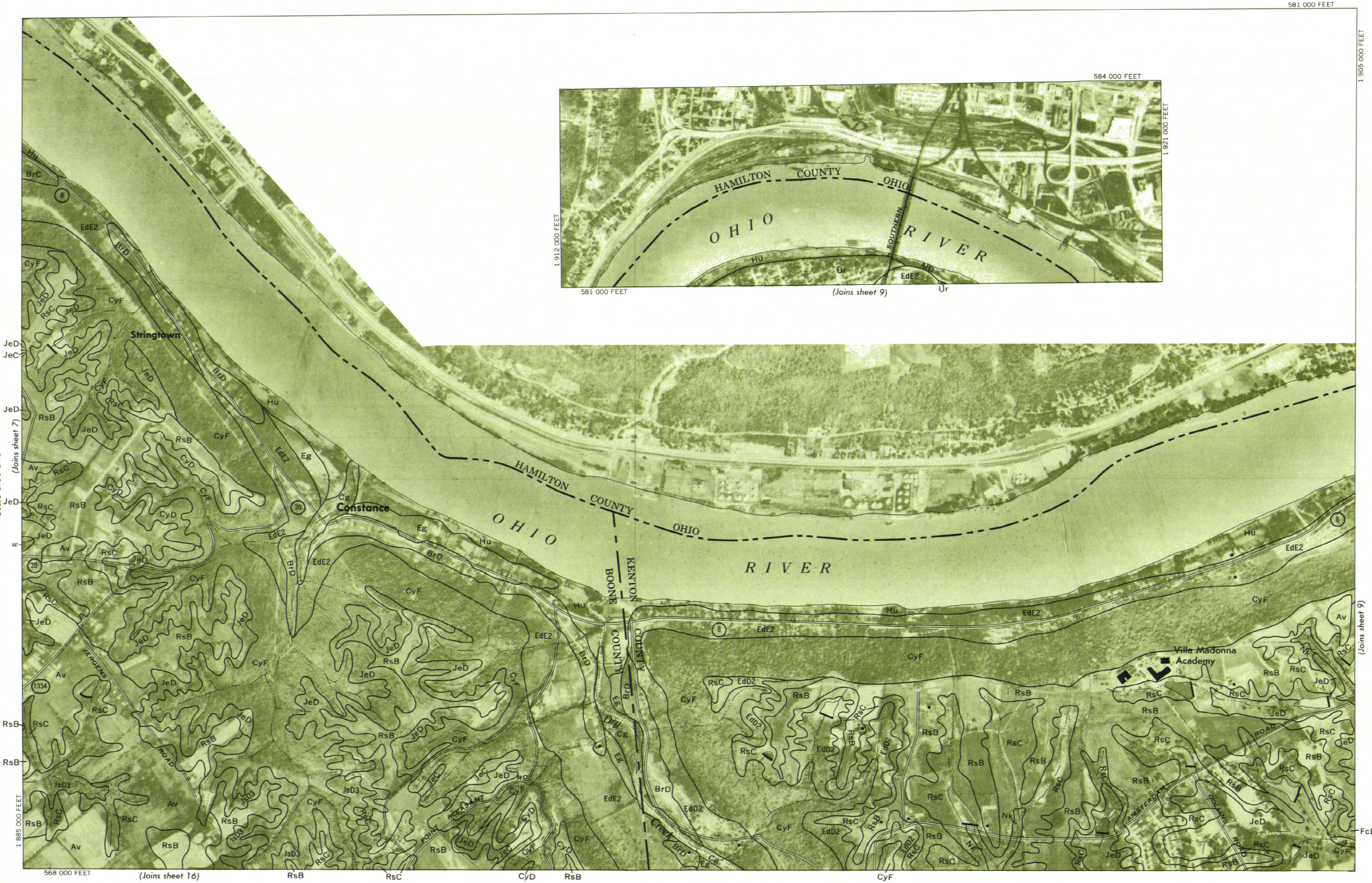


Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 7

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



N

1 Mile

5 000 Feet

Scale 1:15 840

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

(Joins inset, sheet 8)

581 000 FEET

1 905 000 FEET

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 17)

1 925 000 FEET

568 000 FEET

9

N

1 Mile

5 000 Feet

Scale 1:15 840

0 0 1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 10

(Joins sheet 4)

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 18)

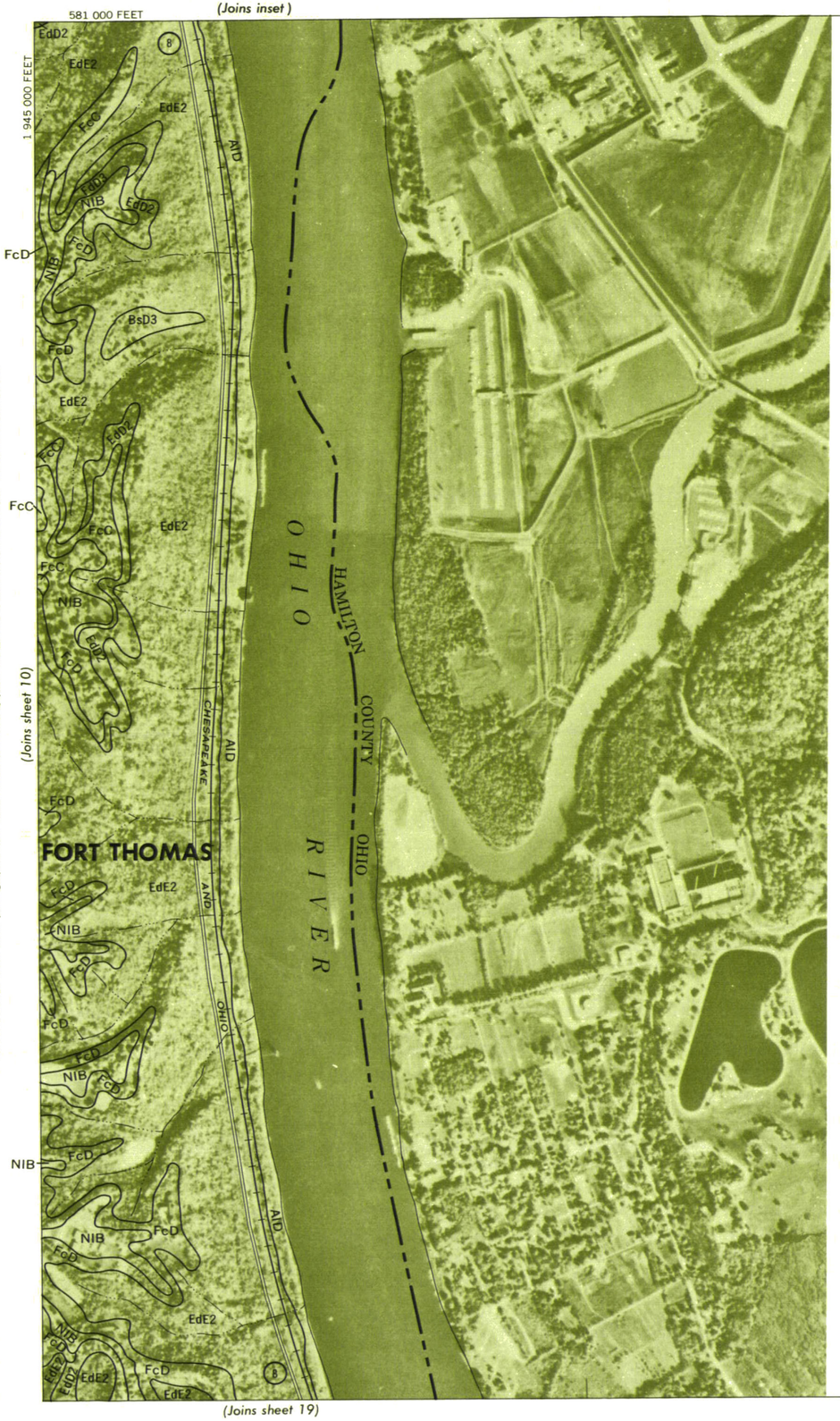
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

581 000 FEET

(Joins inset)

1 945 000 FEET



(Joins sheet 10)

(Joins sheet 19)

588 000 FEET

1 945 000 FEET

(Joins sheet 4)

(Joins upper left)

581 000 FEET

1 965 000 FEET

568 000 FEET

11

N

1 Mile

5 000 Feet

Scale 1:15 840

1 5 000 | ¾ 4 000 | ½ 3 000 | ¼ 2 000 | 0 1 000 | 0

(12)

N

1 Mile

5 000 Feet

Scale 1:15 840

575 000 FEET

1 825 000 FEET

1 816 000 FEET

568 000 FEET

1 805 000 FEET

555 000 FEET

OHIO RIVER

DEARBORN COUNTY, INDIANA

OHIO COUNTY, INDIANA

Petersburg

AURORA FERRY ROAD

(Joins upper right)

(Joins inset)

(Joins sheet 13)

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

RsC 568 000 FEET EdE2

1 825 000 FEET

(Joins sheet 5)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 21)

555 000 FEET

1 845 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

1 5 000 0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000

14

N

1 Mile

5 000 Feet

Scale 1:15 840

0 1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000

(Joins sheet 6)

(Joins sheet 13)

(Joins sheet 22)

(Joins sheet 15)

555 000 FEET

568 000 FEET

1 865 000 FEET

1 845 000 FEET

Burlington
(county seat)

FAIRGROUNDS

Double Lick Creek

Woolper Creek

Allen Fork

Brandywine Creek

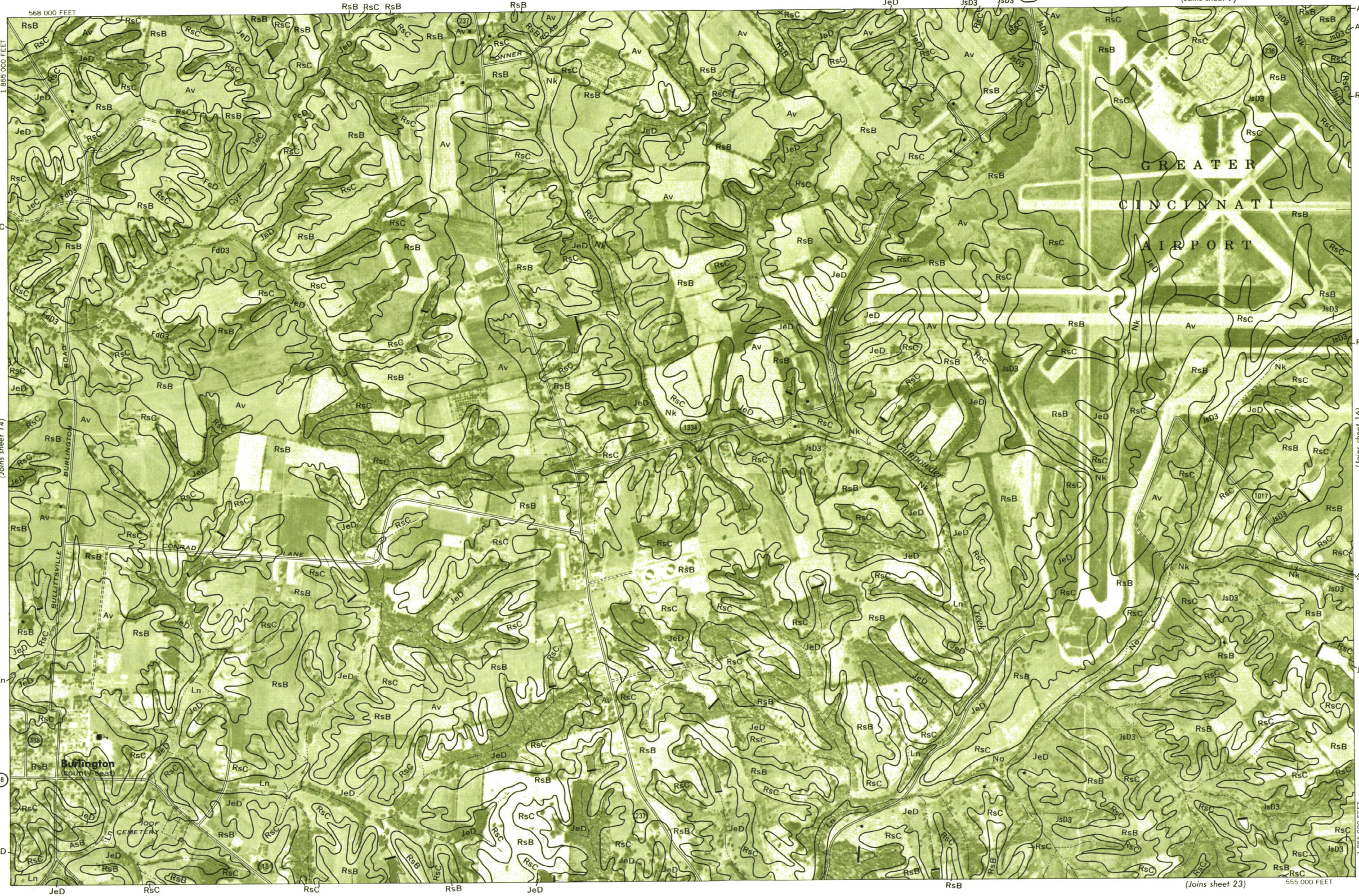
EASTON ROAD

FILLEY ROAD

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 15



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

15

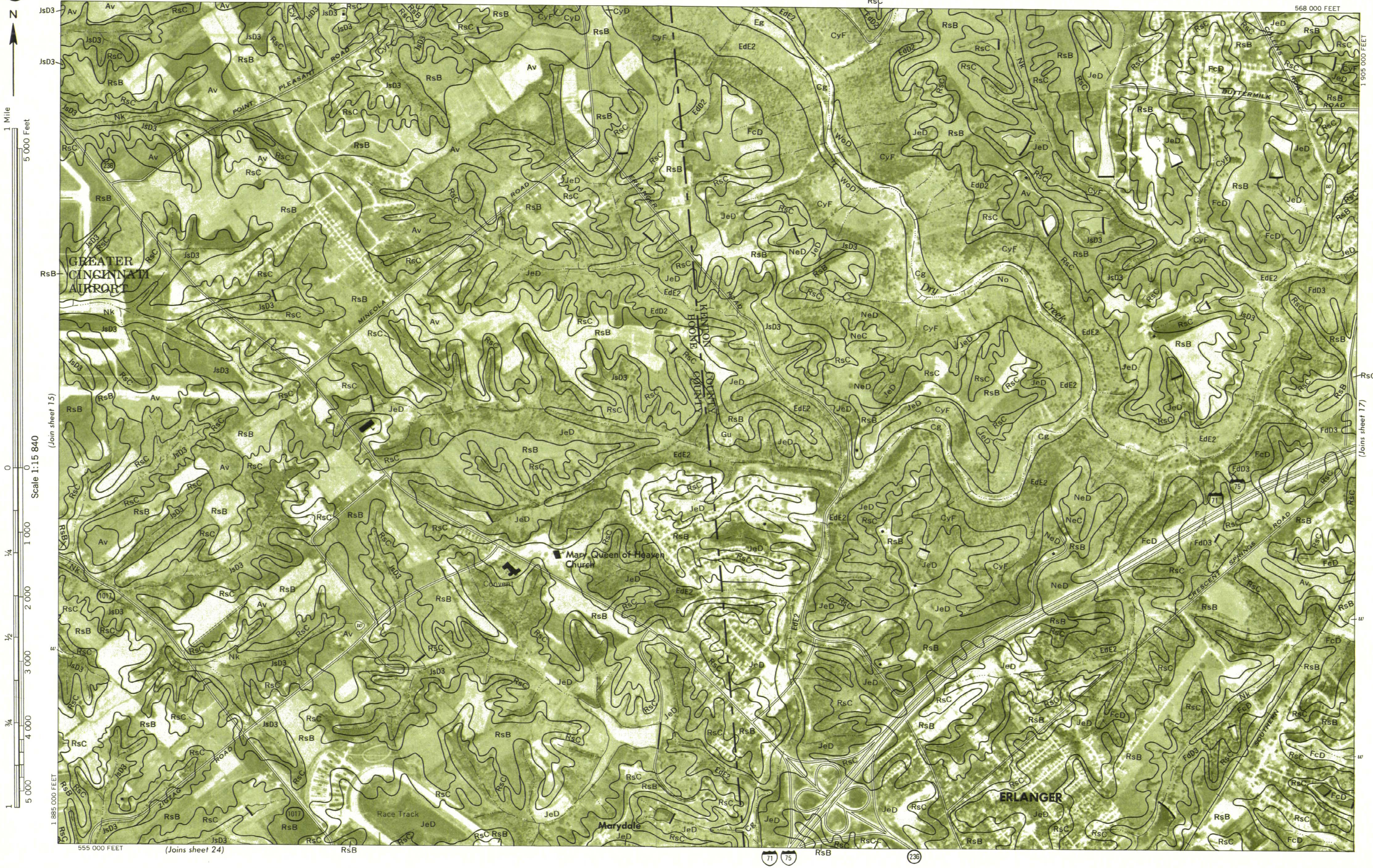
N

1 Mile

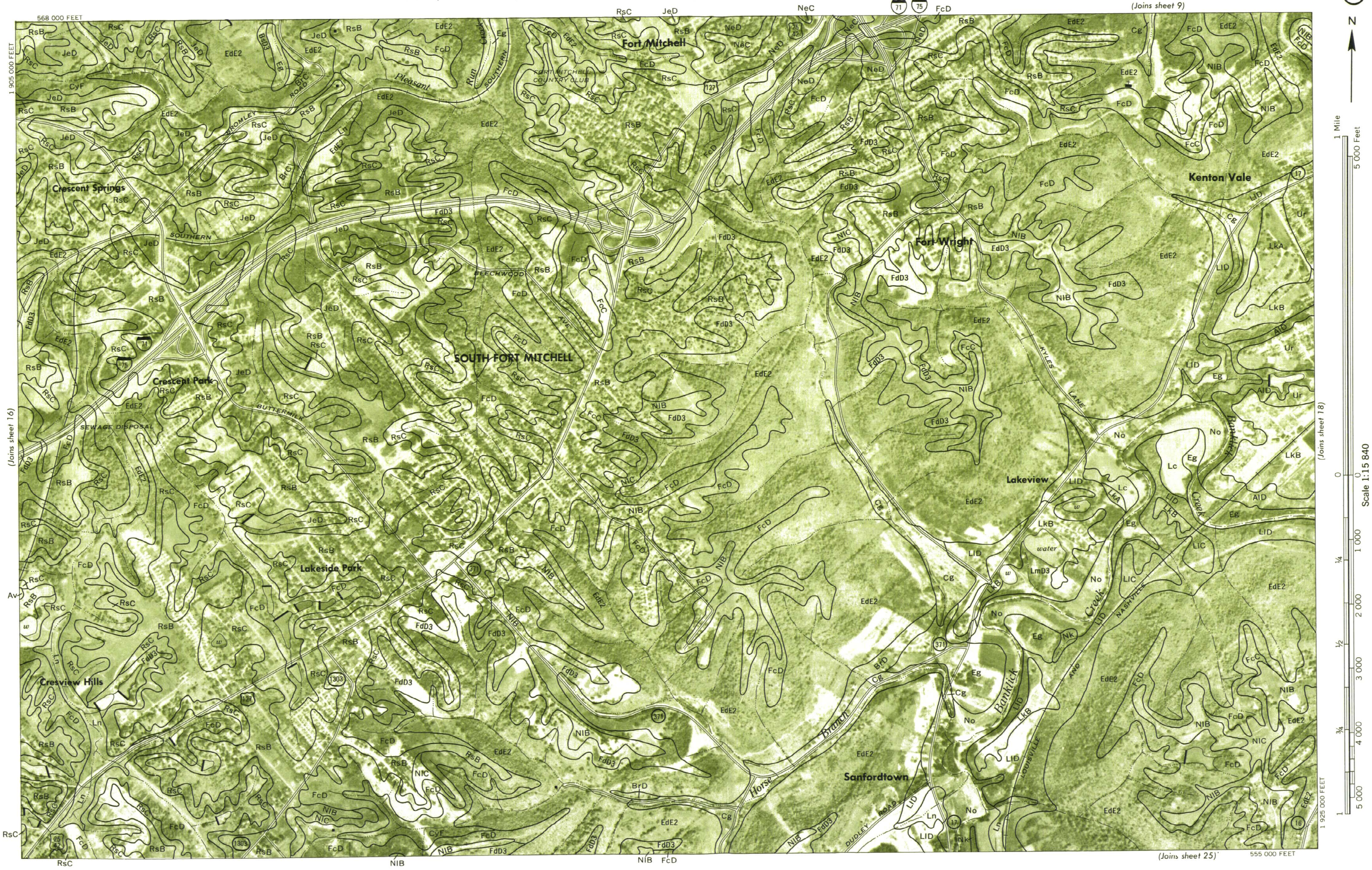
5 000 Feet

Scale 1:15 840

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 16



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

N

1 Mile

5 000 Feet

Scale 1:15 840

(Joins sheet 10)

(Joins sheet 17)

(Joins sheet 26)

(Joins sheet 19)

568 000 FEET

1 945 000 FEET

1 925 000 FEET

555 000 FEET

LATONIA

COVINGTON

WINSTON PARK

Forest Hills

Wilders

HIGHLAND HEIGHTS

Dale School

Threemile Creek

Bankhead Creek

KENTON CO

CAMPBELL CO

LICKING RIVER

LOUISVILLE AND NASHVILLE

GRAND AVE

MASON ROAD

THREEMILE ROAD

JOHNS HILL ROAD

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

568 000 FEET

(Joins sheet 11)

1 945 000 FEET

(Joins sheet 18)

OHIO RIVER

HAMILTON COUNTY, OHIO

Brent

Crestview

Silver Grove

Fourmile Creek

Duck Creek

Uhl Creek

CHESAPEAKE AND OHIO

DODSWORTH LANE

WINTERS LANE

OWL CREEK ROAD

UHL ROAD

(Joins sheet 20)

(Joins sheet 27)

555 000 FEET

1 965 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

20

N

568 000 FEET

1 985 000 FEET

1 Mile

5 000 Feet

Scale 1:15 840

0 1 000 2 000 3 000 4 000 5 000

1 965 000 FEET

555 000 FEET

(Joins sheet 19)

(Joins sheet 28)

OHIO RIVER

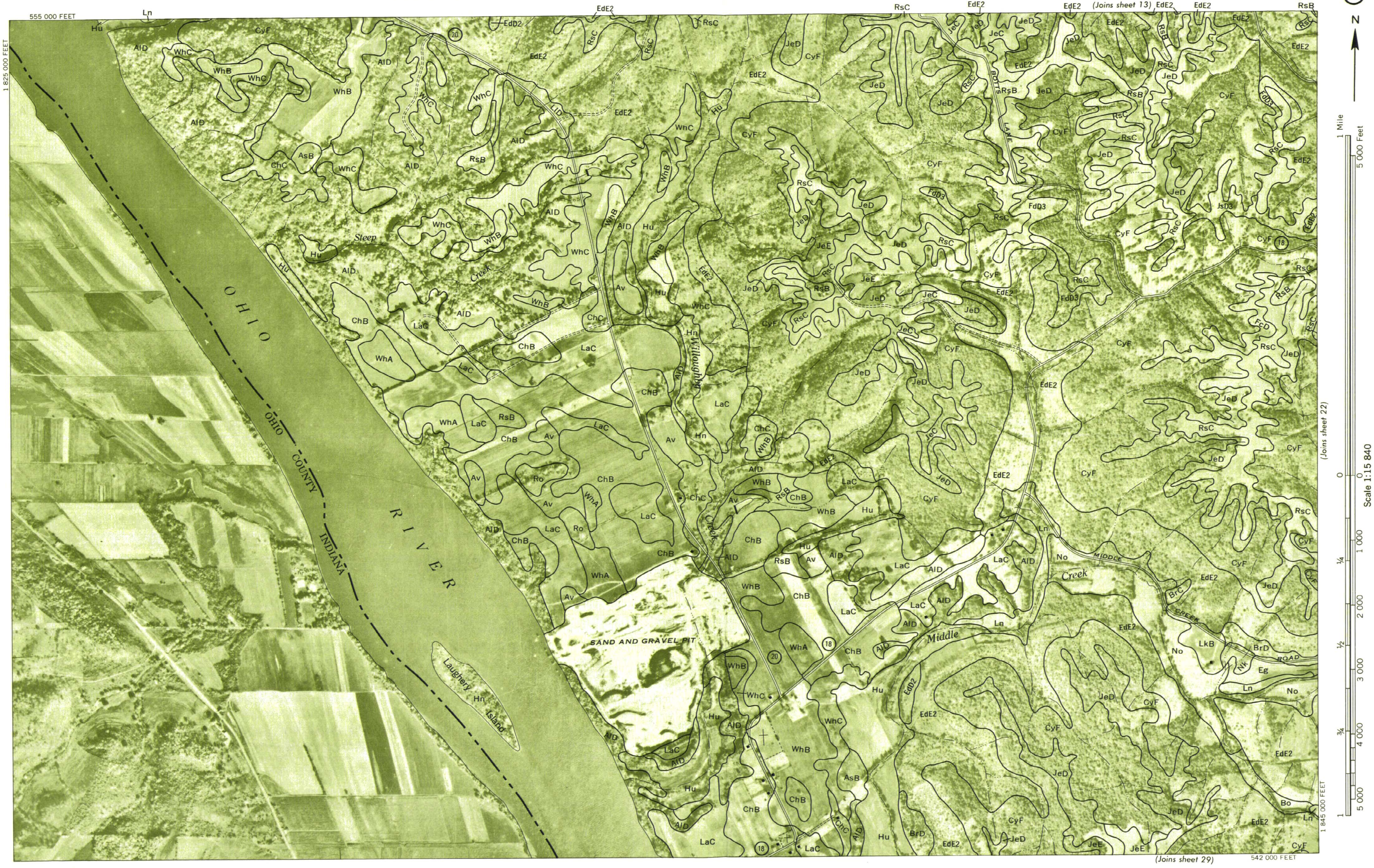
HAMILTON COUNTY OHIO

CHESAPEAKE AND OHIO

Melbourne

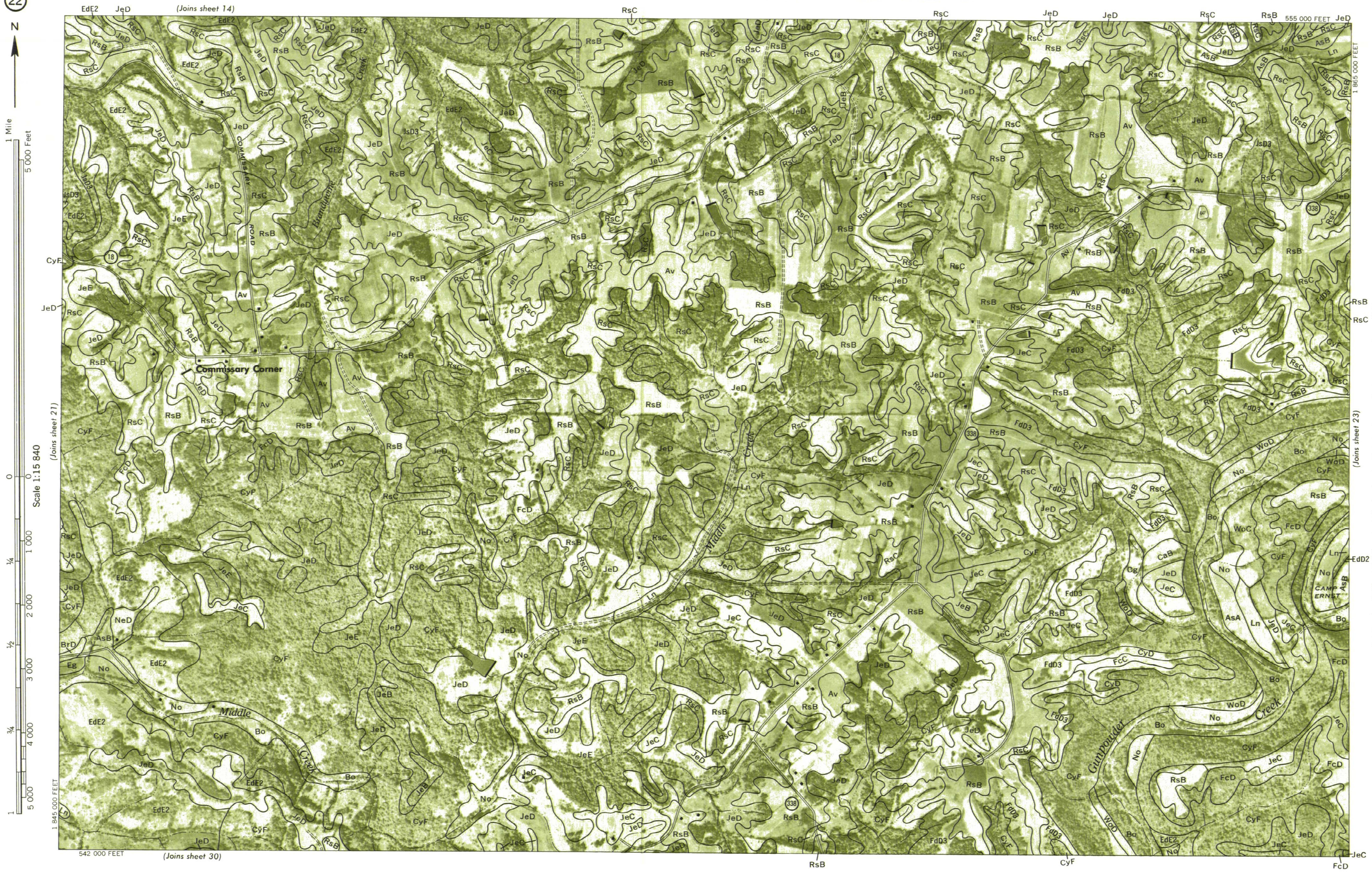
Av Ro Hu AlD WhB RsB Nk WhA LaC BsB3 EdE2 WhC Ln LlC BrC FcC EdD2

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 22



555 000 FEET

1 865 000 FEET

(Join sheet 15)

Limaburg

Hopeful Heights

ROGERS LANE

CAMP ERNST ROAD

BEAMAN LANE

ZIGZAG ROAD

Gunpowder Creek

South Fork

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 31)

1 885 000 FEET

542 000 FEET

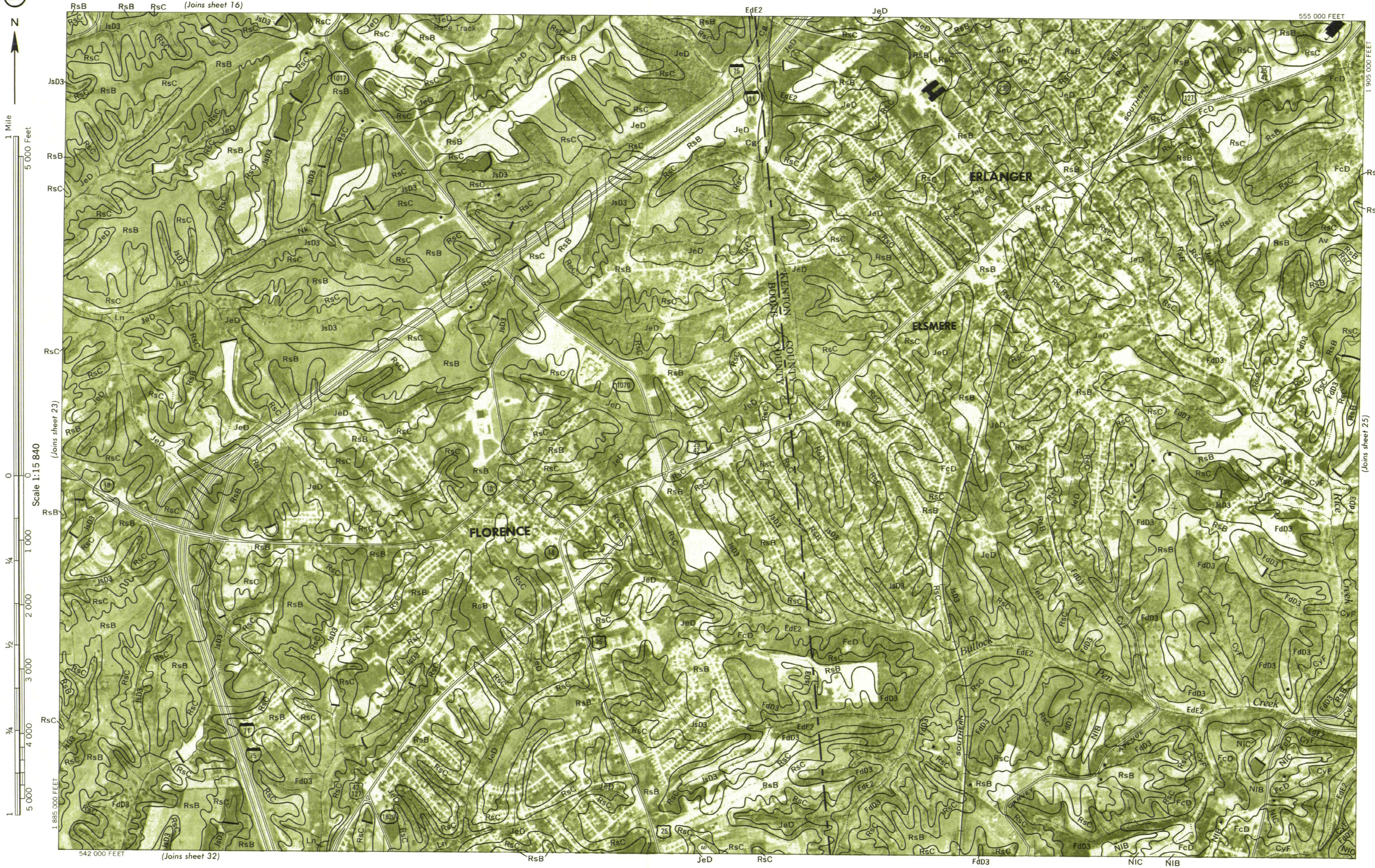
N

1 Mile

5 000 Feet

Scale 1:15 840

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

(Joins sheet 17)

555 000 FEET

1 905 000 FEET

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 33)

1 925 000 FEET

542 000 FEET

N

Scale 1:15 840

1 Mile

5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

Maurice

Summit Hills Heights

Eggleston Church

Banklick Church

Horse Branch

Bullock Pen Creek

Banklick Creek

Hotts Branch

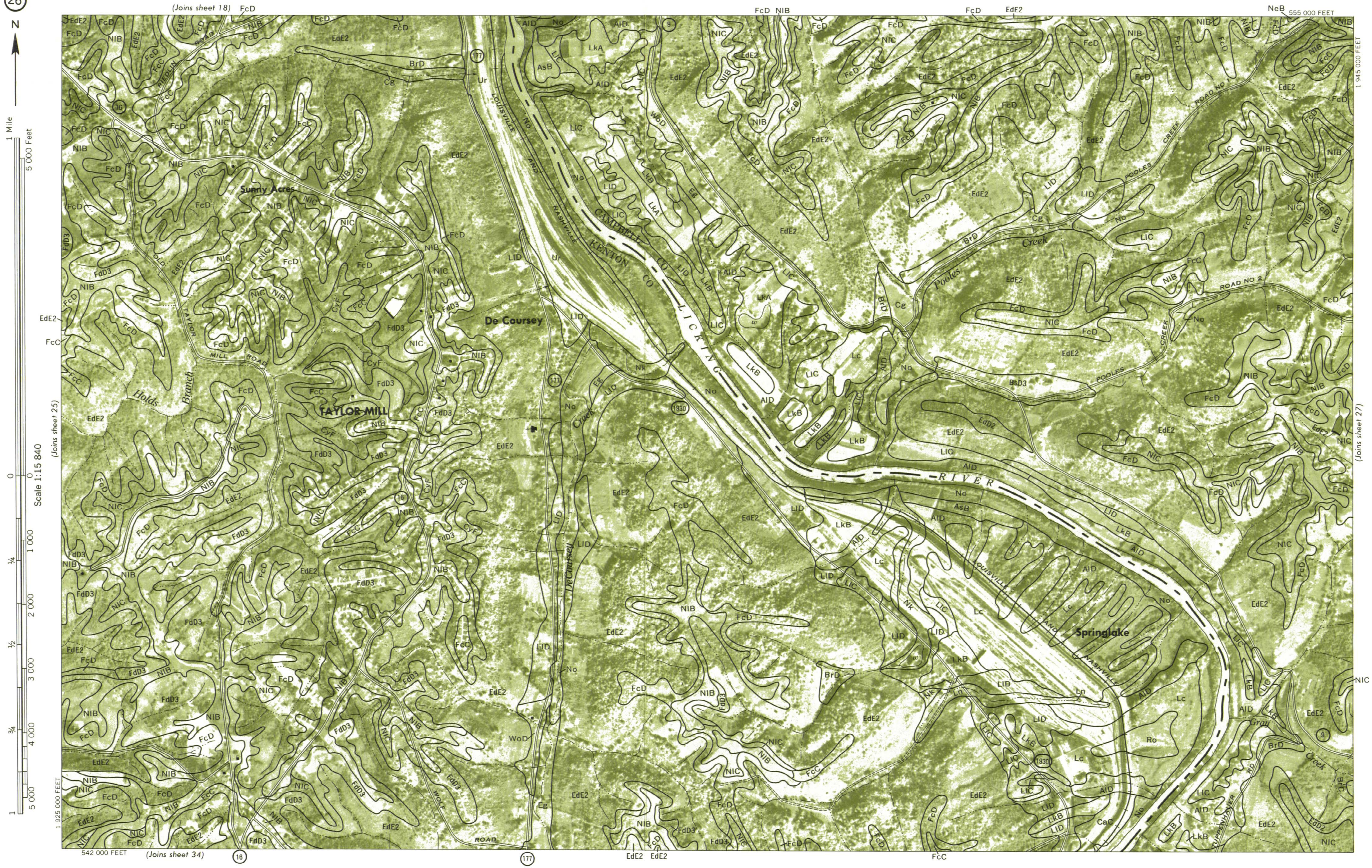
Wayman Branch

Dudley Road

Louisville and Nashville

water

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

555 000 FEET

1 945 000 FEET

Cold Spring

Crestview

Low Gap

Gray

Tug

Creek

U.S. 27

OLD U.S. 27

MURPHY ROAD

LOW GAP ROAD

UPPER TUG FORK

LOWER TUG FORK

BRD ROAD

No FORK BRD ROAD

(Joins sheet 19)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 35)

542 000 FEET

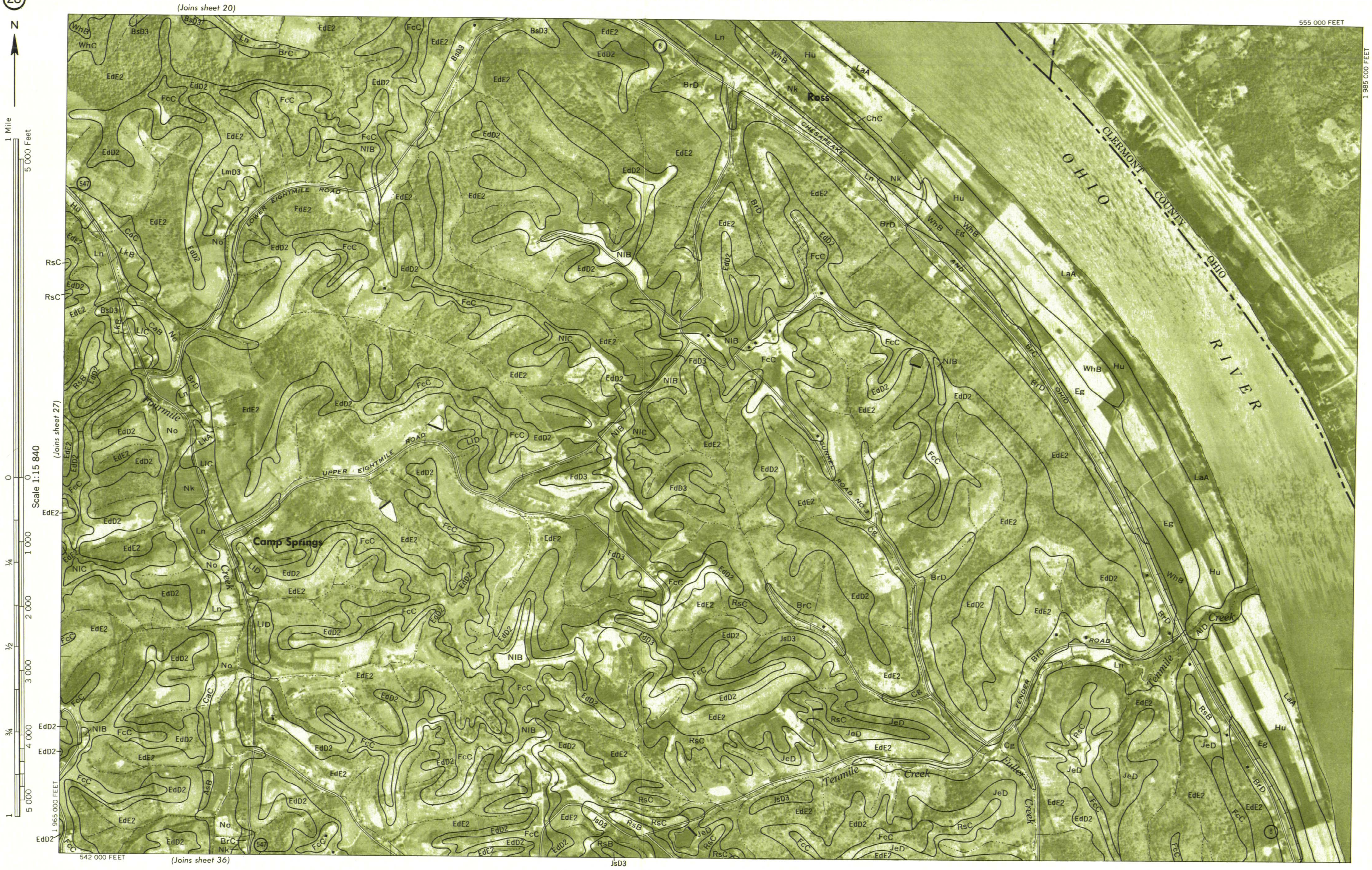
N

1 Mile

5 000 Feet

Scale 1:15 840

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 28



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

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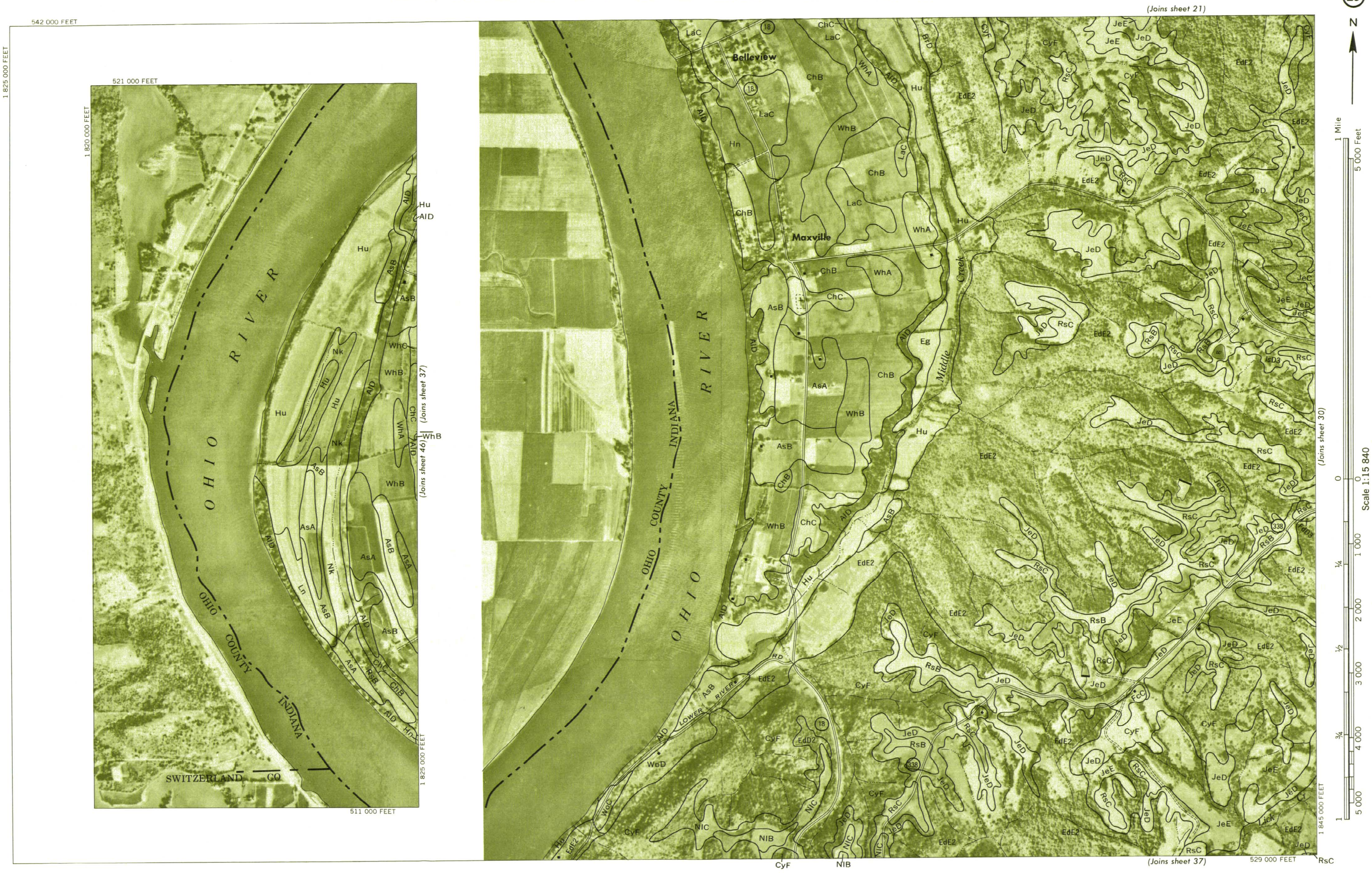
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



N

1 Mile

5 000 Feet

Scale 1:15 840

(Joins sheet 22)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 38)

542 000 FEET

1 865 000 FEET

1 845 000 FEET

529 000 FEET

Waterloo

Beech Grove Church

Gunpowder Creek

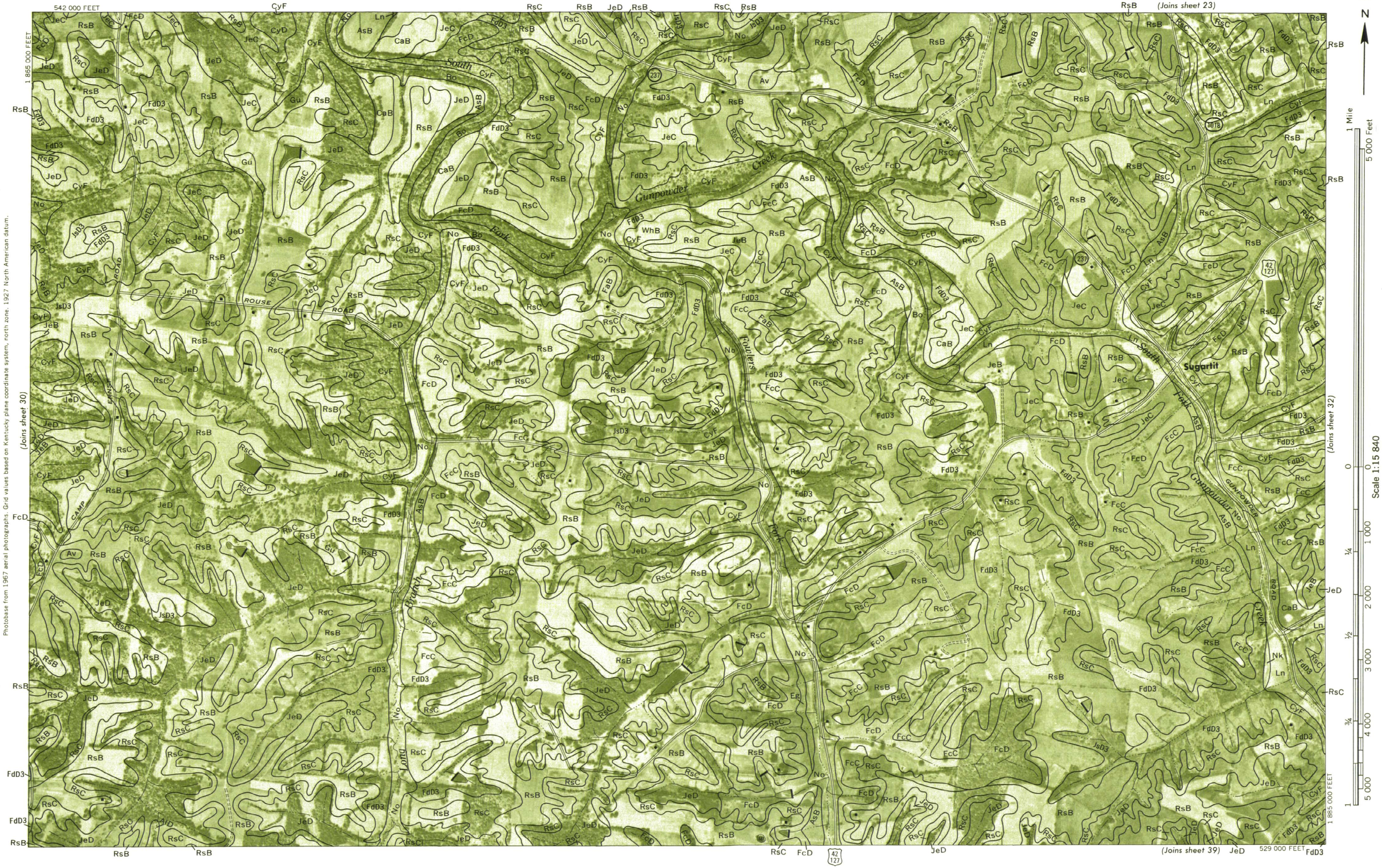
CAMP POWDERHORN

Lick Creek

BOONE ROAD

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

32

N

Scale 1:15 840

1 Mile

5 000 Feet

(Joins sheet 24)

(Joins sheet 31)

(Joins sheet 40)

(Joins sheet 33)

542 000 FEET

1 905 000 FEET

1 885 000 FEET

529 000 FEET

FLORENCE

Devon

Racetrack

water

Creek

Fork

Run

AVENUE

GARVEY

SOUTHERN

RICHARDSON

ROAD

BRISTOW

MT ZION

GUNPOWDER

EVERGREEN

DRIVE

STATION

KENTON COUNTY

SOUTHERN

RsB RsC FdD3 FcD NIB NIC EdE2 JeD Av Ln CyF AsB FsD3 JsD3 JeB JeC CaB FdD FcC w

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

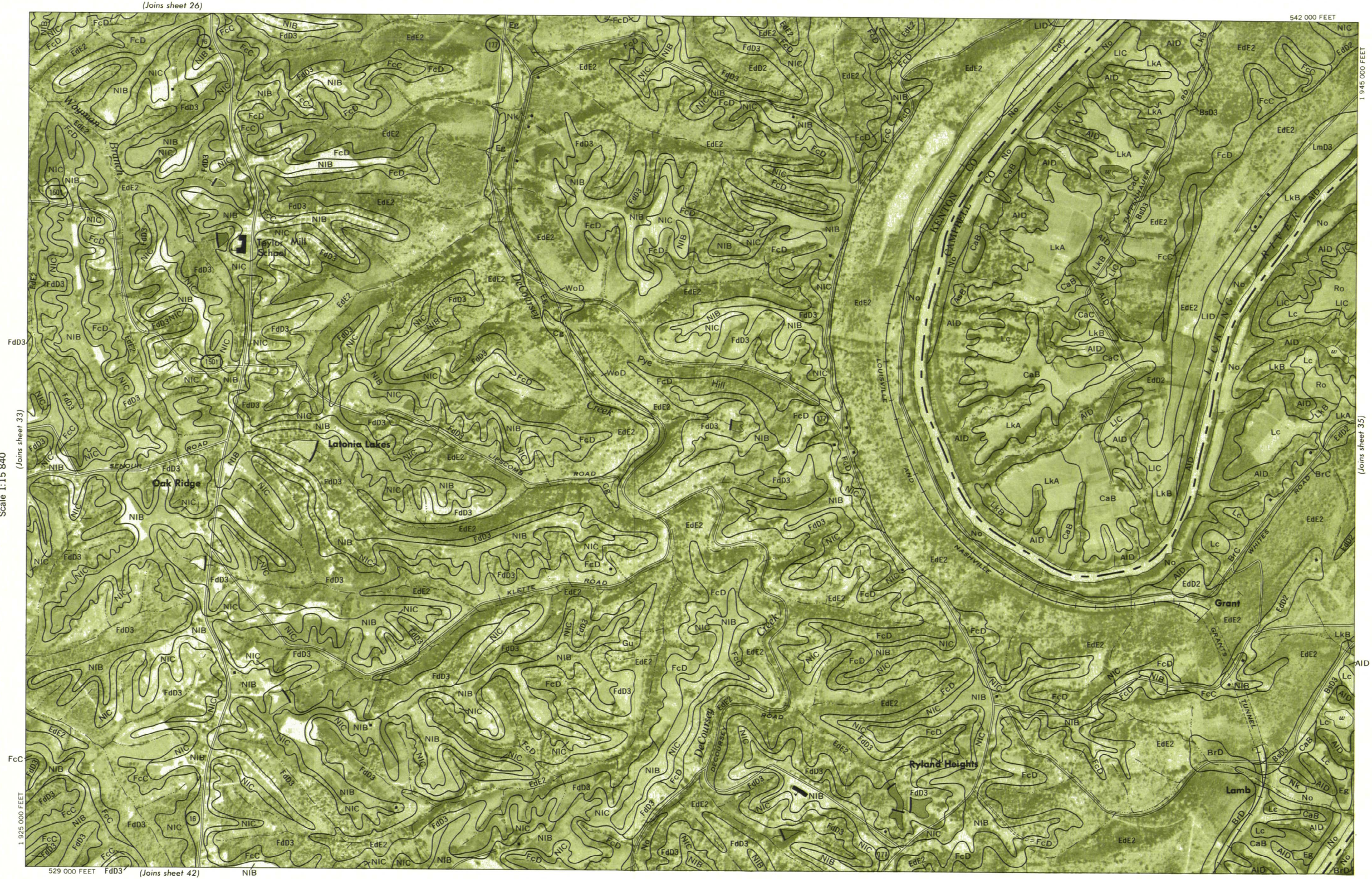
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

N

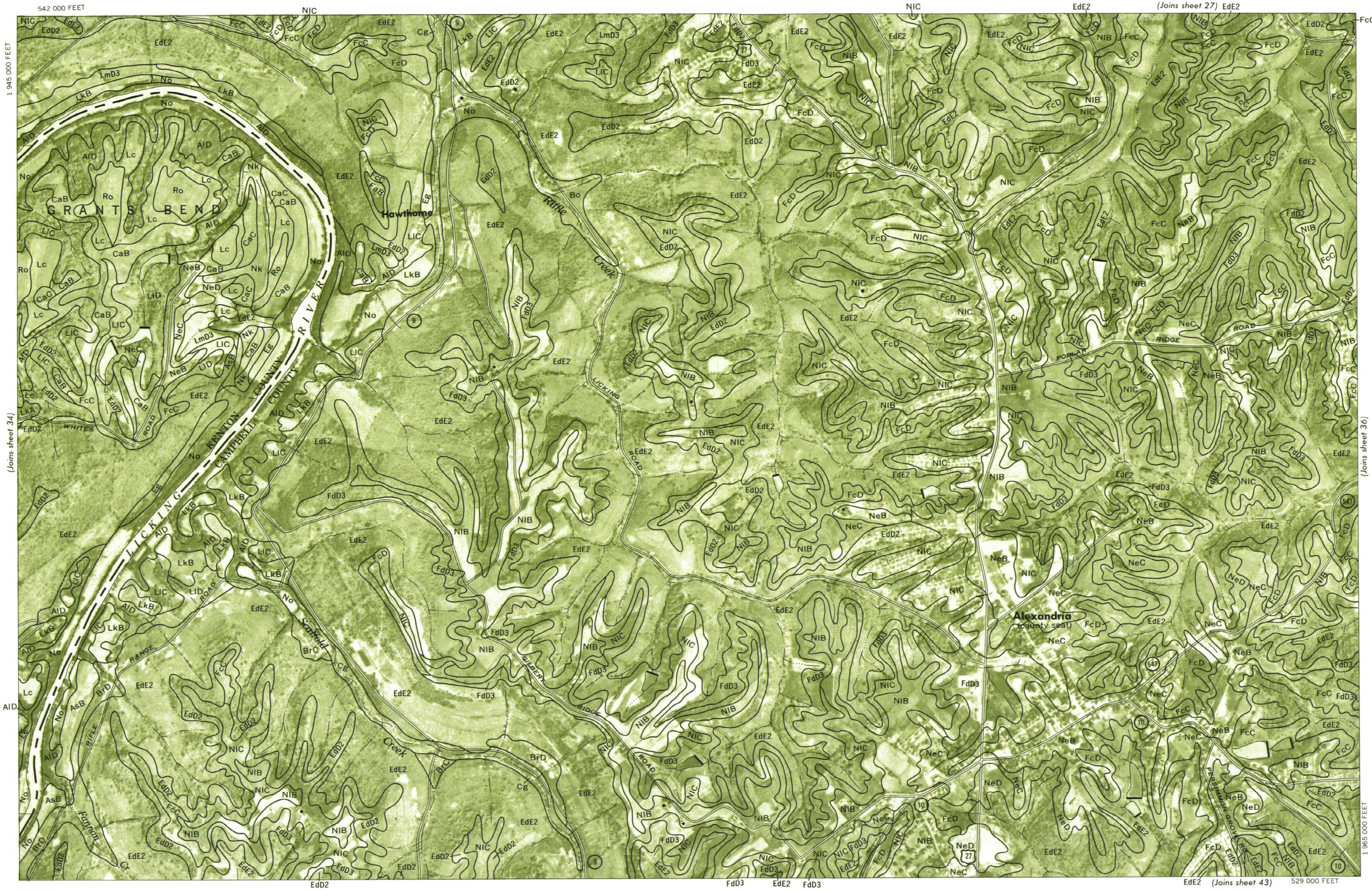
Scale 1:15 840
1 Mile
5 000 Feet

(Joins sheet 32)
(Joins sheet 25)
(Joins sheet 34)
(Joins sheet 41)

542 000 FEET
529 000 FEET
1 905 000 FEET
1 925 000 FEET



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

(Joins sheet 28)

542 000 FEET

1 985 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

0 1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000

(Joins sheet 35)

1 965 000 FEET

529 000 FEET

(Joins sheet 44)

(Joins inset, sheet 45)

TUG FORK ROAD

TENDER ROAD

TRUESDELL ROAD

GRANDVIEW ROAD

PAINTER ROAD

CHESAPEAKE AND OHIO

Fourmile Creek

Willow Run

Lick Branch

Fuller Creek

Slab Run

Twelvemile Creek

Twelvemile Branch

Humphrey Branch

Alexander Reservoir

Oneonta

Twelvemile Church

EdD2 EdE2 FcC FcD NIB LID LIC LmD3 JsD3 RsB RsC JeD NeD NeC NeB EdE2 CaB CaC BrC BrD Ln No Nk Eg Cg BsD3 WhB WhC AlD LkA LkB LkC FdD3 Bo Hu WoC WoD Av

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 37

37

N

529 000 FEET

1 825 000 FEET

(Joins sheet 29)

OHIO RIVER

OHIO COUNTY INDIANA

Rabbit Hash

Fest Bend Church

Lower River Road

Creek

Lick Run

Gunpowder Creek

Riddles Run

(Joins inset, sheet 29)

(Joins sheet 38)

(Joins sheet 46)

516 000 FEET

1 845 000 FEET

1 Mile

5 000 Feet

Scale 1:15 840

1 0 1 000

¼ 0 2 000

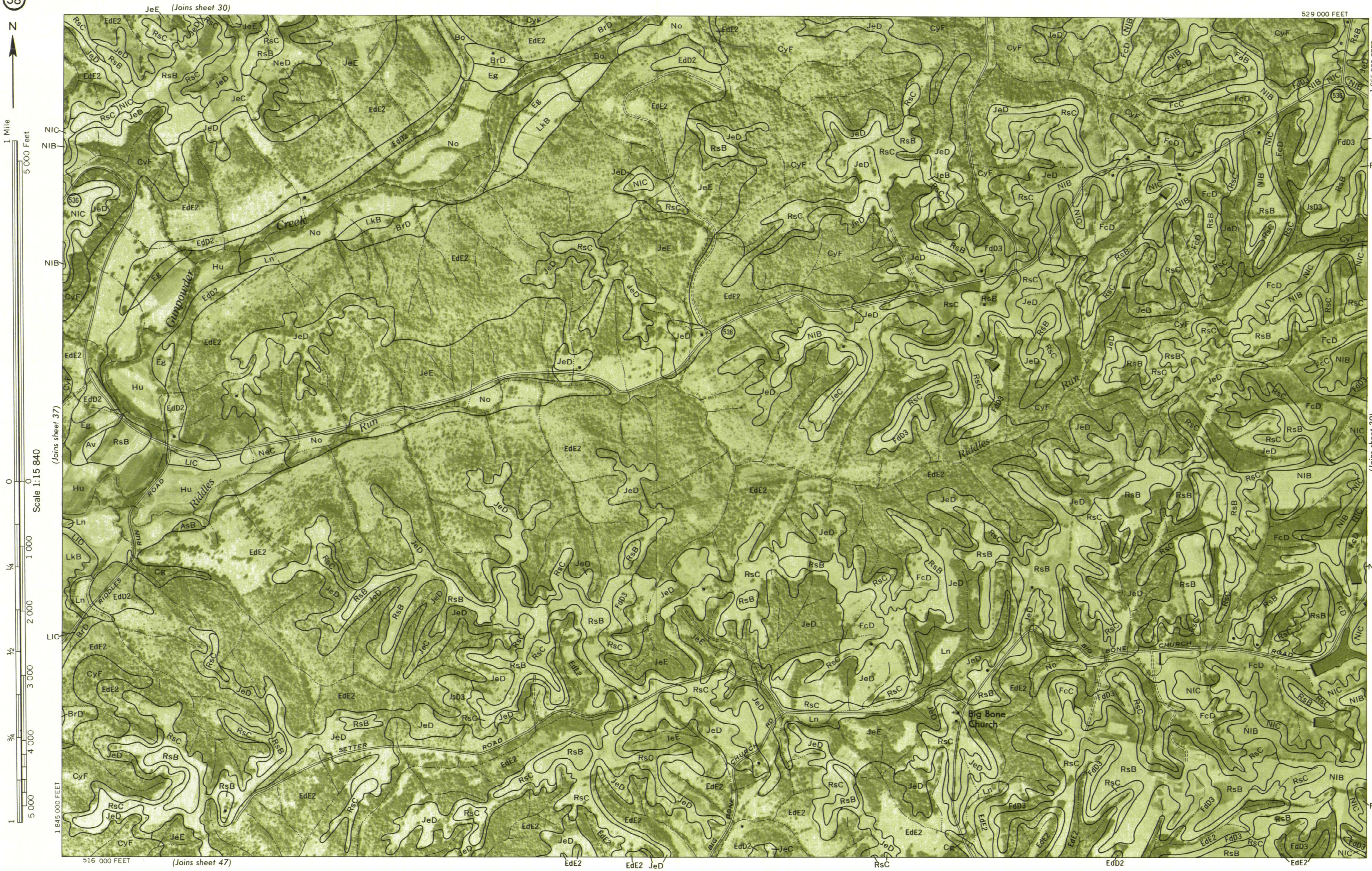
½ 3 000

¾ 4 000

1 5 000

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

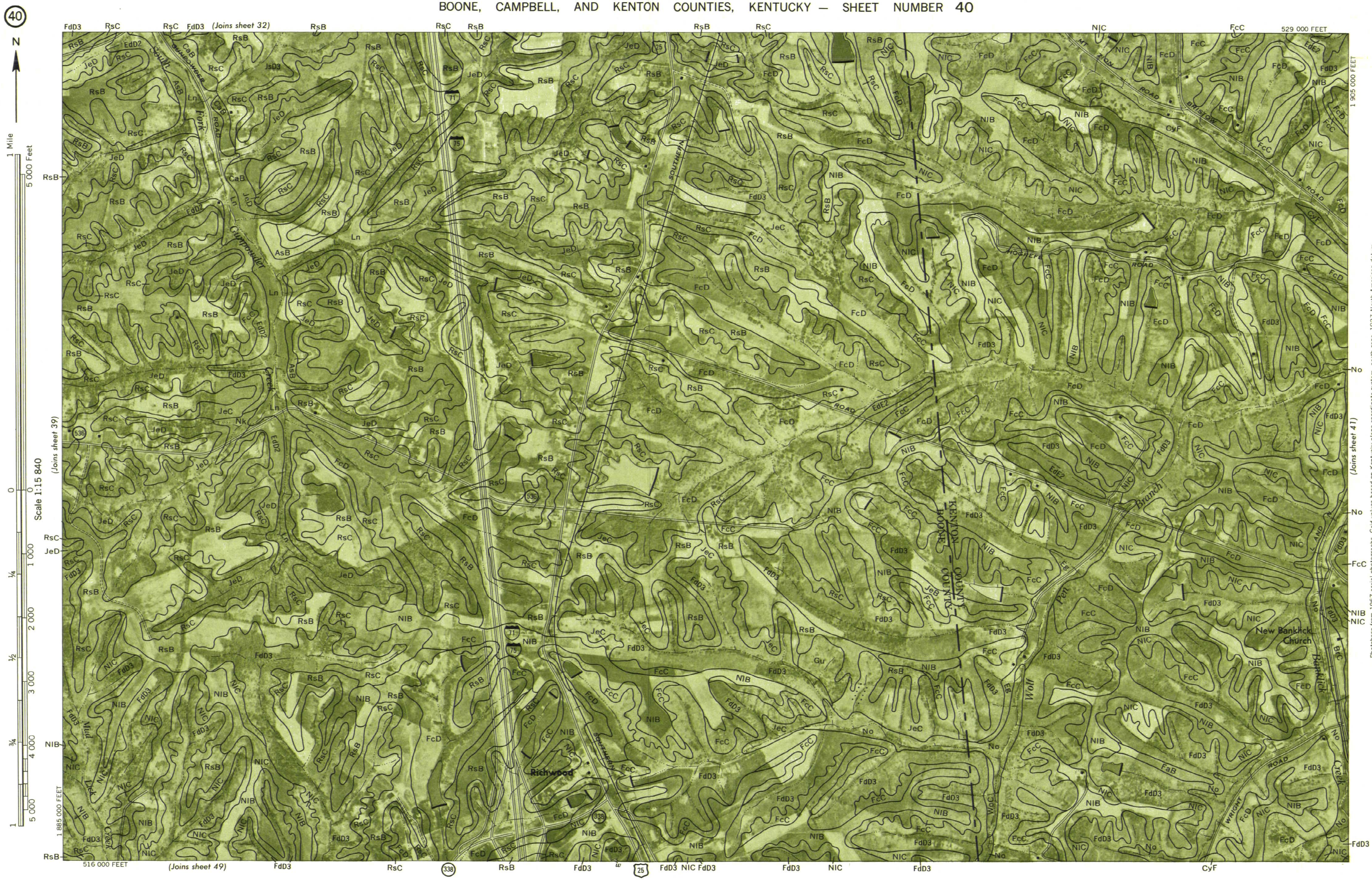
BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 37



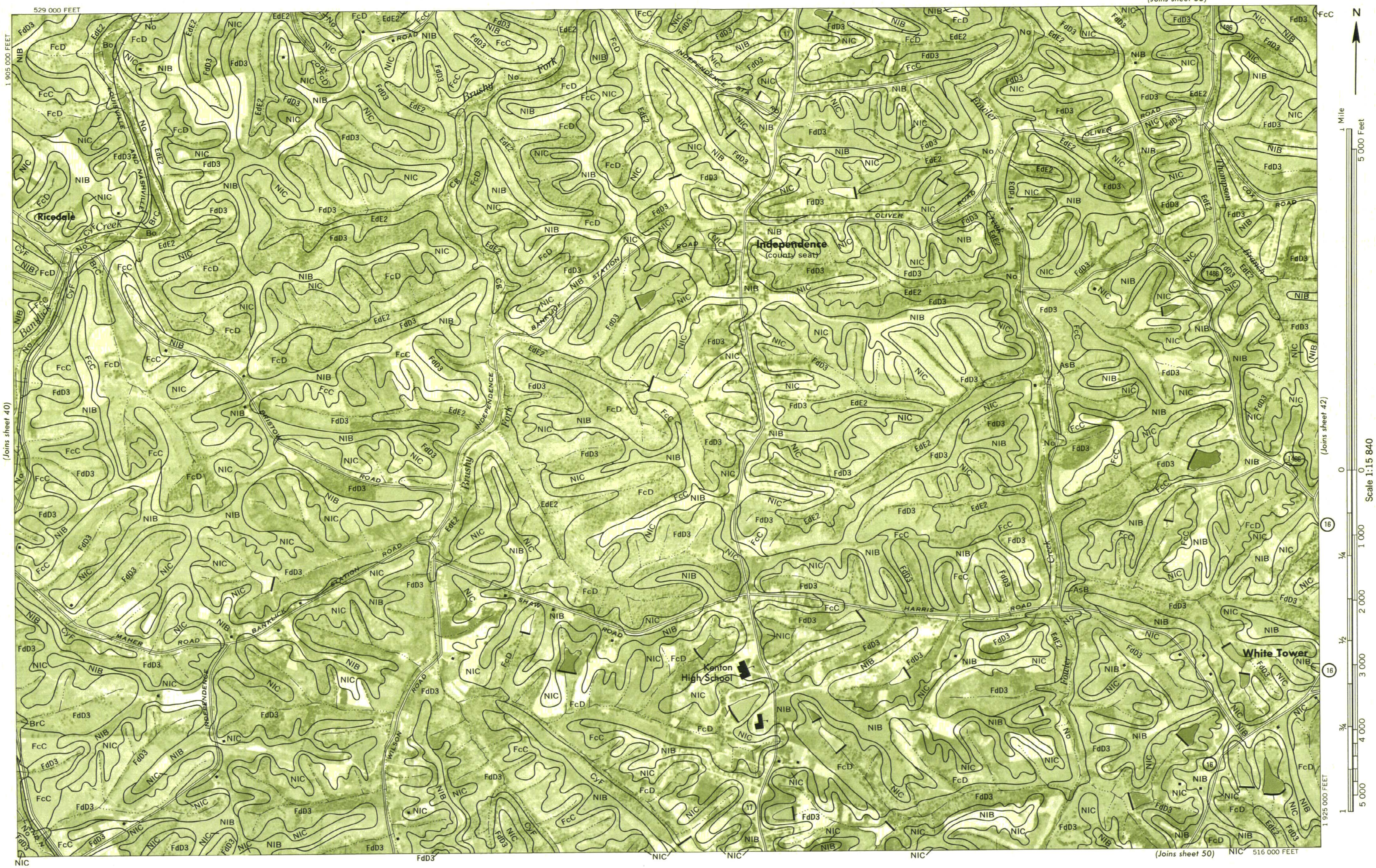
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 39

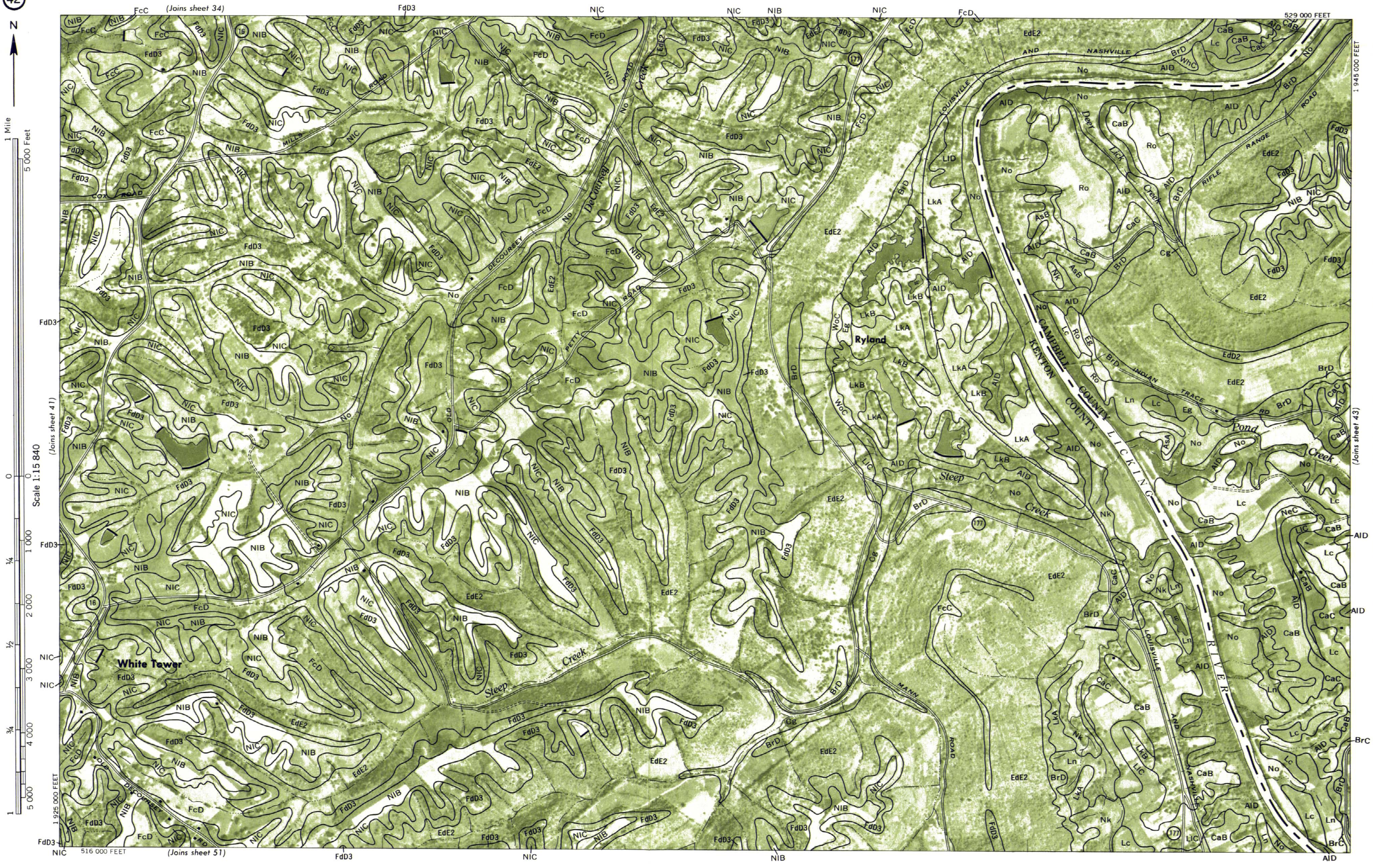
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

529 000 FEET

1 945 000 FEET

(Joins sheet 42)

(Joins sheet 35)

(Joins sheet 44)

(Joins sheet 52)

516 000 FEET

1 965 000 FEET

N

Scale 1:15 840

1 Mile

5 000 Feet

Fannan Creek

Pond Creek

Pond

Creek

Pond

Creek

Claryville

STEVENS ROAD

POPLAR THICKET ROAD

POND CREEK ROAD

INDIAN TRACE ROAD

MILLER ROAD

OLD STATE ROAD

PERSIMMON GROVE ROAD

LICKERT ROAD

LICKERT ROAD

WOFFORD ROAD

(Joins sheet 36)

529 000 FEET

1 985 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

1 0 1/4 1/2 3/4 1

5 000 0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 43)

1 965 000 FEET

516 000 FEET

(Joins sheet 53)

(Joins sheet 45)

Twelvemile Creek

No Brush Creek

Brush Creek

Twelvemile Creek

TRACE ROAD

CARTHAGE ROAD

PERSIMMON GROVE ROAD

Carthage

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

529 000 FEET

1 985 000 FEET

(Joins inset)

New Richmond Station

CHESAPEAKE AND OHIO

CARTHAGE ROAD

CLERMONT COUNTY

OHIO RIVER

Run

Painter Run

TRACE ROAD

CHESAPEAKE AND OHIO

CALIFORNIA ROAD

Turkey Run

California

Oneonta

CHESAPEAKE AND OHIO

(Joins sheet 44)

(Joins sheet 54)

516 000 FEET

1 999 000 FEET

542 000 FEET

1 985 000 FEET

(Joins sheet 36)

(Joins upper left)

529 000 FEET

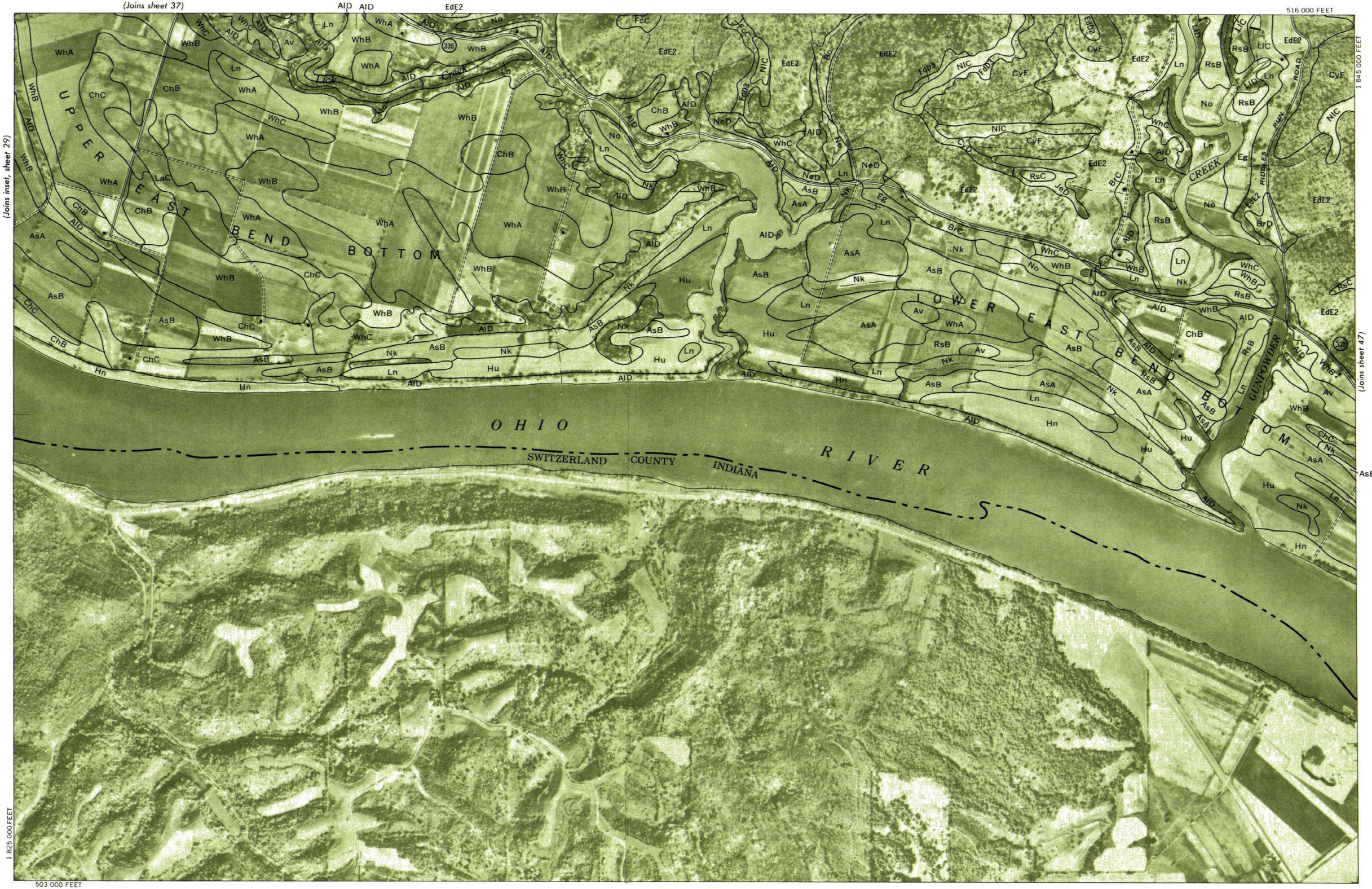
1 989 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840



1 Mile
5 000 Feet
Scale 1:15 840

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 47

516 000 FEET

1 845 000 FEET

(Joins sheet 38)

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 55)

1 865 000 FEET

503 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

1 5 000 0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

Hamilton

Big Bone

BIG BONE LICK STATE PARK

OHIO RIVER

SWITZERLAND CO IND

LOWER EAST BOTTOM

Big Bone Creek

Gum Branch

CHURCH ROAD

BIG BONE ROAD

HUFF ROAD

BENDER ROAD

UNION ROAD

1925

338

(48)

N

1 Mile

5 000 Feet

Scale 1:15 840

1 865 000 FEET

1 885 000 FEET

516 000 FEET

503 000 FEET

(Joins sheet 47)

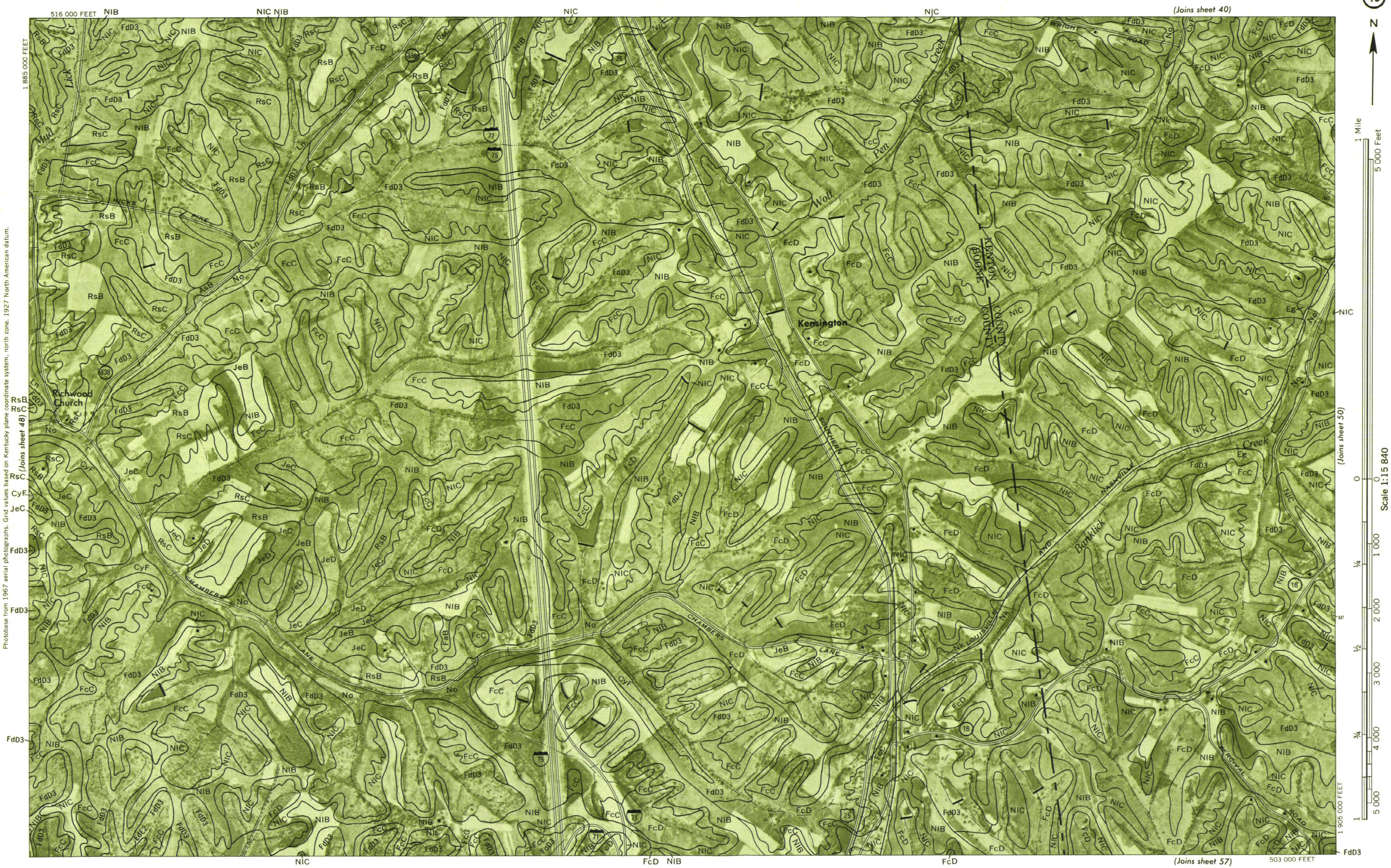
(Joins sheet 39)

(Joins sheet 49)

(Joins sheet 56)

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

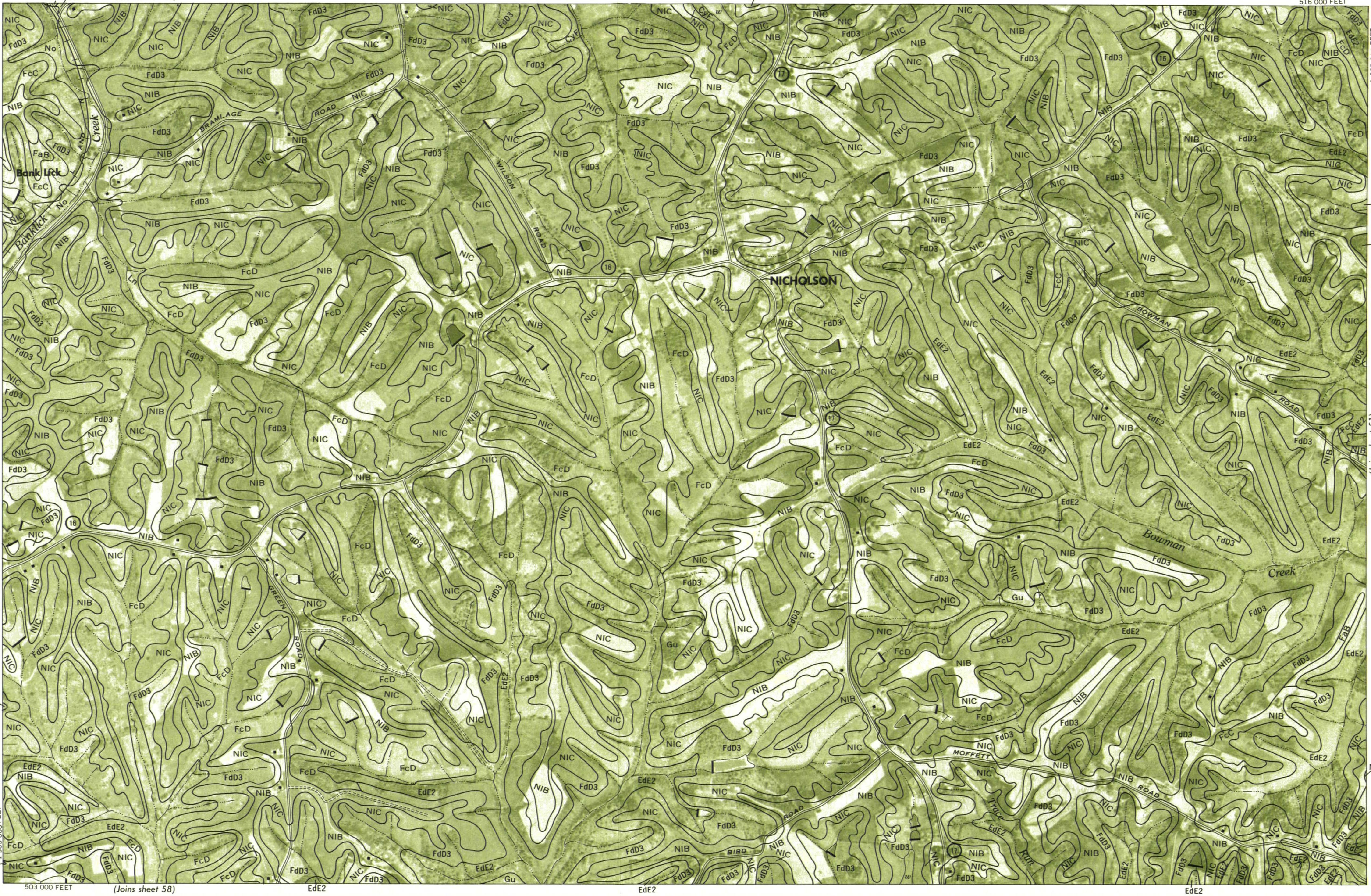
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

(50)

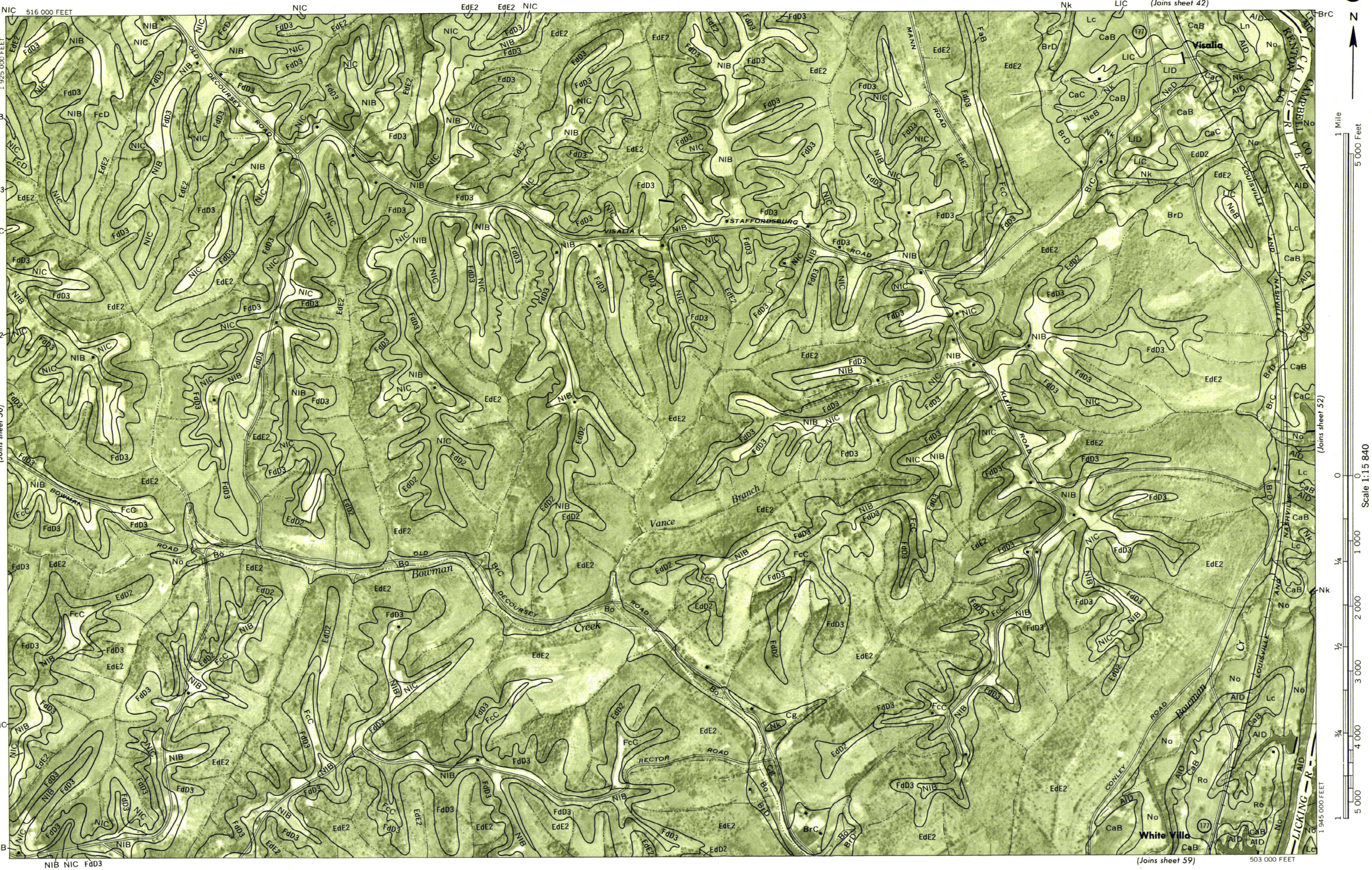
N



1 Mile
5 000 Feet
Scale 1:15 840
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

N

1 Mile

5 000 Feet

Scale 1:15 840

(Joins sheet 43)

(Joins sheet 51)

(Joins sheet 53)

(Joins sheet 60)

516 000 FEET

1 965 000 FEET

1 945 000 FEET

503 000 FEET

KENTON COUNTY

CAMPBELL COUNTY

OHIO RIVER

VISALIA ROAD

MADDOX RIDGE ROAD

PLEASANT RIDGE ROAD

Pleasant Ridge Church

LEES CREEK ROAD

POND CREEK ROAD

PHILLIPS CREEK

WOLFE ROAD

OLD STATE ROAD

Aspen Grove

CAMPBELL COUNTY PARK

Campbell County Lake

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

N

516 000 FEET

1 965 000 FEET

(Joins sheet 44)

(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 61)

503 000 FEET

1 985 000 FEET

Persimmon Grove

PERSIMMON GROVE ROAD

WAGNER ROAD

BURNS BIZFOLD ROAD

Twelvemile Creek

Gubser Mill

Campbell County Lake

1 Mile

5 000 Feet

Scale 1:15 840

1 0 1/4 0 1/2 1 000 3/4 2 000 1 2 000 3 000 1 1/4 4 000 1 1/2 5 000

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

(Joins sheet 45)

516 000 FEET

2 005 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

(Joins sheet 53)

1 985 000 FEET

503 000 FEET

(Joins sheet 62)

OHIO RIVER

CLERMONT COUNTY, OHIO

Twelvemile Creek

Flagg Spring Creek

CALIFORNIA ROAD

TURKEY RUN ROAD

YOUNG TRACE ROAD

SHAKERTOWN ROAD

CHESAPEAKE AND OHIO

CAMP MEACHAM

Beagle

Mentor

Flagg Spring

BrD Brookston silty clay loam, 6 to 12 percent slopes

BrC Brookston silty clay loam, 2 to 6 percent slopes

Cg Cagle silt loam, 0 to 2 percent slopes

Eg Eagleville silt loam, 0 to 2 percent slopes

JeD Jeffersonville silt loam, 6 to 12 percent slopes

JeC Jeffersonville silt loam, 2 to 6 percent slopes

EdE2 Edenton silty clay loam, 12 to 20 percent slopes, eroded

EdD2 Edenton silty clay loam, 6 to 12 percent slopes, eroded

FcC Fincastle silt loam, 2 to 6 percent slopes

NlB Nolin silt loam, 0 to 3 percent slopes

RsC Rossmoyne silt loam, 6 to 12 percent slopes

RsB Rossmoyne silt loam, 2 to 6 percent slopes

LmD3 Lowell silty clay loam, 6 to 12 percent slopes, severely eroded

BsD3 Bonnell silty clay loam, 6 to 12 percent slopes, severely eroded

JsD3 Jessup silty clay loam, 6 to 12 percent slopes, severely eroded

LkA Lakin silt loam, 0 to 2 percent slopes

LkB Lakin silt loam, 2 to 6 percent slopes

LlB Lindside silt loam, 2 to 6 percent slopes

LlC Lindside silt loam, 6 to 12 percent slopes

LlD Lindside silt loam, 12 to 20 percent slopes

CaB Caneyville silt loam, 2 to 6 percent slopes

CaC Caneyville silt loam, 6 to 12 percent slopes

No Nolin silt loam, 0 to 3 percent slopes

Ln Lindside silt loam, 0 to 2 percent slopes

Nk Newark silt loam, 0 to 2 percent slopes

NeD Newark silty clay loam, 6 to 12 percent slopes, severely eroded

WhB Whitson silt loam, 2 to 6 percent slopes

ChB Chavies fine sandy loam, 2 to 6 percent slopes

ChC Chavies fine sandy loam, 6 to 12 percent slopes

AsB Ashton silt loam, 2 to 6 percent slopes

AsA Ashton silt loam, 0 to 2 percent slopes

AlD Allegheny silt loam, 6 to 12 percent slopes

Av Avonburg silt loam, 0 to 2 percent slopes

Hu Huntington silt loam, 0 to 2 percent slopes

WoC Woodstock silt loam, 6 to 12 percent slopes

WoD Woodstock silt loam, 12 to 20 percent slopes

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

N

503 000 FEET

1 845 000 FEET

(Joins sheet 47)

(Joins sheet 56)

(Joins sheet 63)

1 865 000 FEET

490 000 FEET

OHIO RIVER

SWITZERLAND COUNTY

INDIANA

GALLATIN COUNTY

HUFF ROAD

BENDER ROAD

BIG BONE CREEK

SOUTH FORK BIG BONE CREEK

Bone Lick Creek

Buzzard Branch

Mud Lick

1925

1 Mile

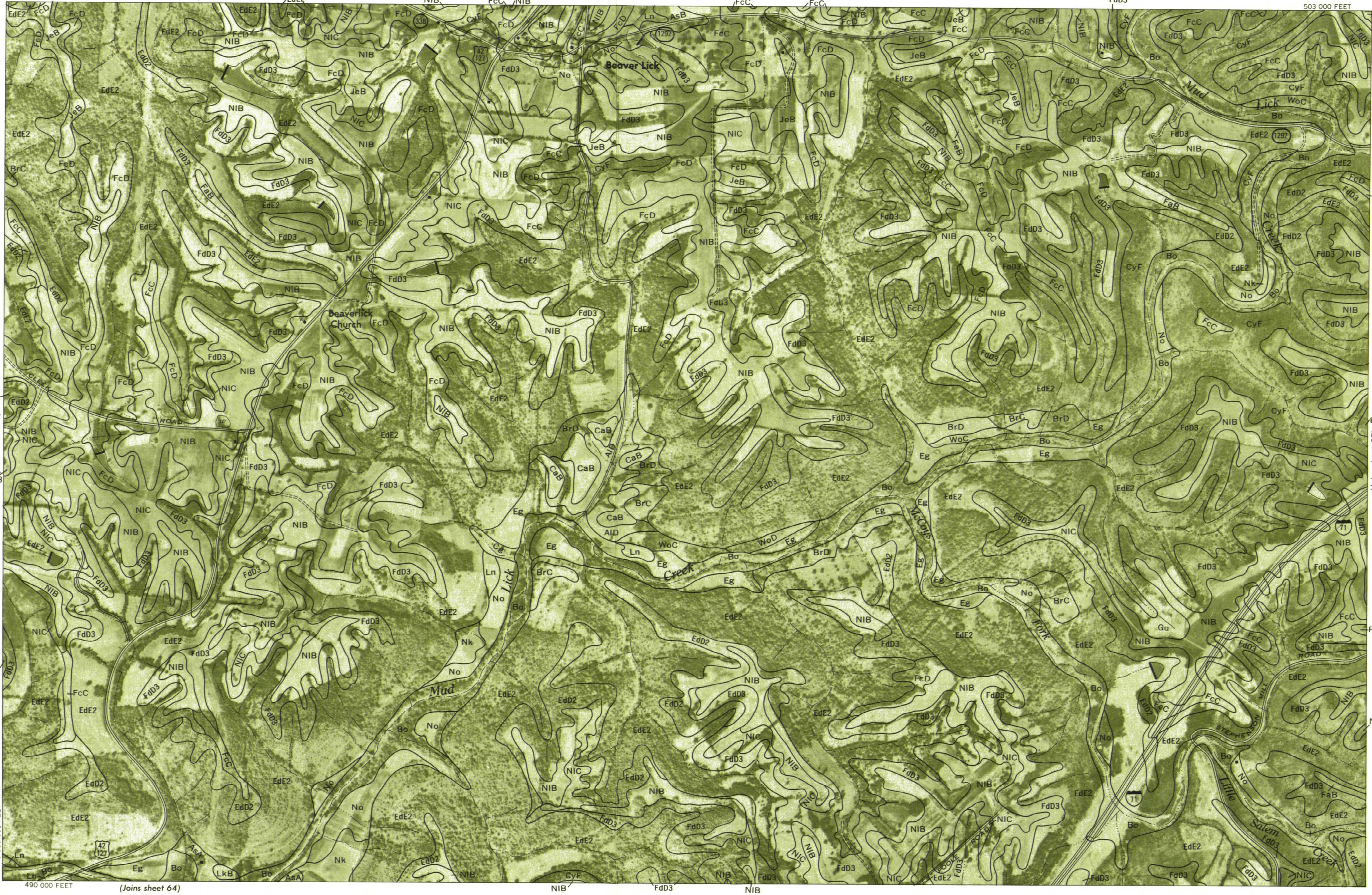
5 000 Feet

Scale 1:15 840

1 5 000 0 1 000 ¼ 2 000 ½ 3 000 ¾ 4 000

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 56

(Joins sheet 48)



(Joins sheet 55)

(Joins sheet 57)

(Joins sheet 64)

N

Scale 1:15 840

1 Mile — 5 000 Feet

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

(Joins sheet 49)

503 000 FEET

1 885 000 FEET

(Joins sheet 56)

(Joins sheet 58)

(Joins sheet 65)

490 000 FEET

1 905 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

0 0

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

Fullers Branch

Stephenson Mill Road

McCoys Fork

Boone Lake

Waltan

Cruises Creek

Louisville and Nashville Southern

Percival Road

High Street

Boone County

Kenton County

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 57

58

N

1 Mile

5 000 Feet

Scale 1:15 840

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

503 000 FEET

1 925 000 FEET

1 905 000 FEET

490 000 FEET

(Joins sheet 50)

(Joins sheet 57)

(Joins sheet 59)

NIB (Joins sheet 66)

NIC

FaB

FcC

Atwood

Cruises Creek

Sawyers Fork

Run

Trace

PERCIVAL ROAD

GREEN ROAD

BIRD ROAD

SPEHMAN ROAD

HEMPFLING ROAD

DIXON RD

17

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 58

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

503 000 FEET

1 925 000 FEET

(Joins sheet 58)

(Joins sheet 51)

(Joins sheet 60)

(Joins sheet 67)

1 945 000 FEET

490 000 FEET

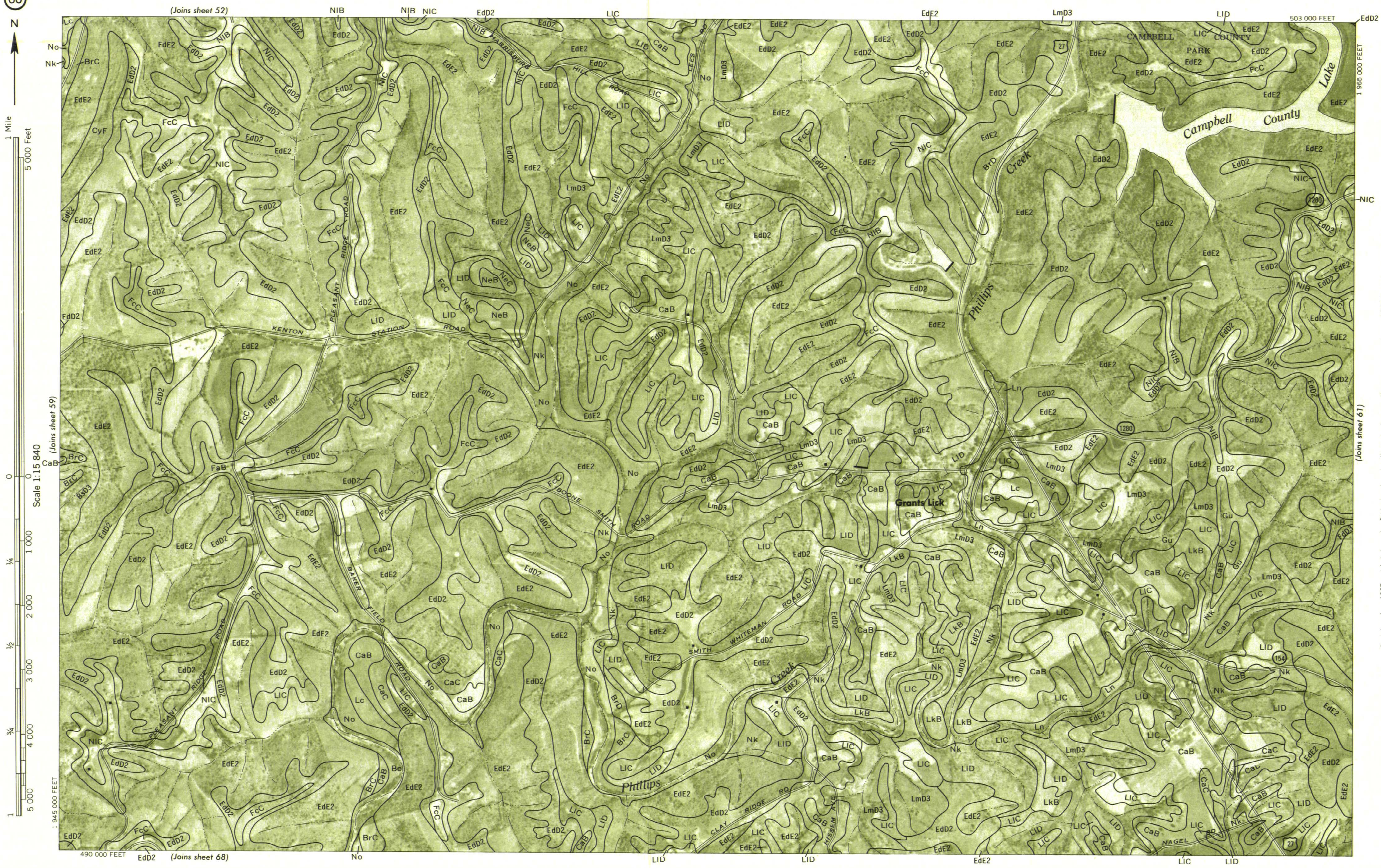
N

1 Mile

5 000 Feet

Scale 1:15 840

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 61

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

503 000 FEET

1 965 000 FEET

(Joins sheet 53)

(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 69)

490 000 FEET

1 985 000 FEET

N

Scale 1:15 840

1 Mile

5 000 Feet

St Peter & Paul School

Kohler

Twelvemile Creek

Creek

BURNS ROAD

BEZOLD ROAD

GOETZ ROAD

FISHER ROAD

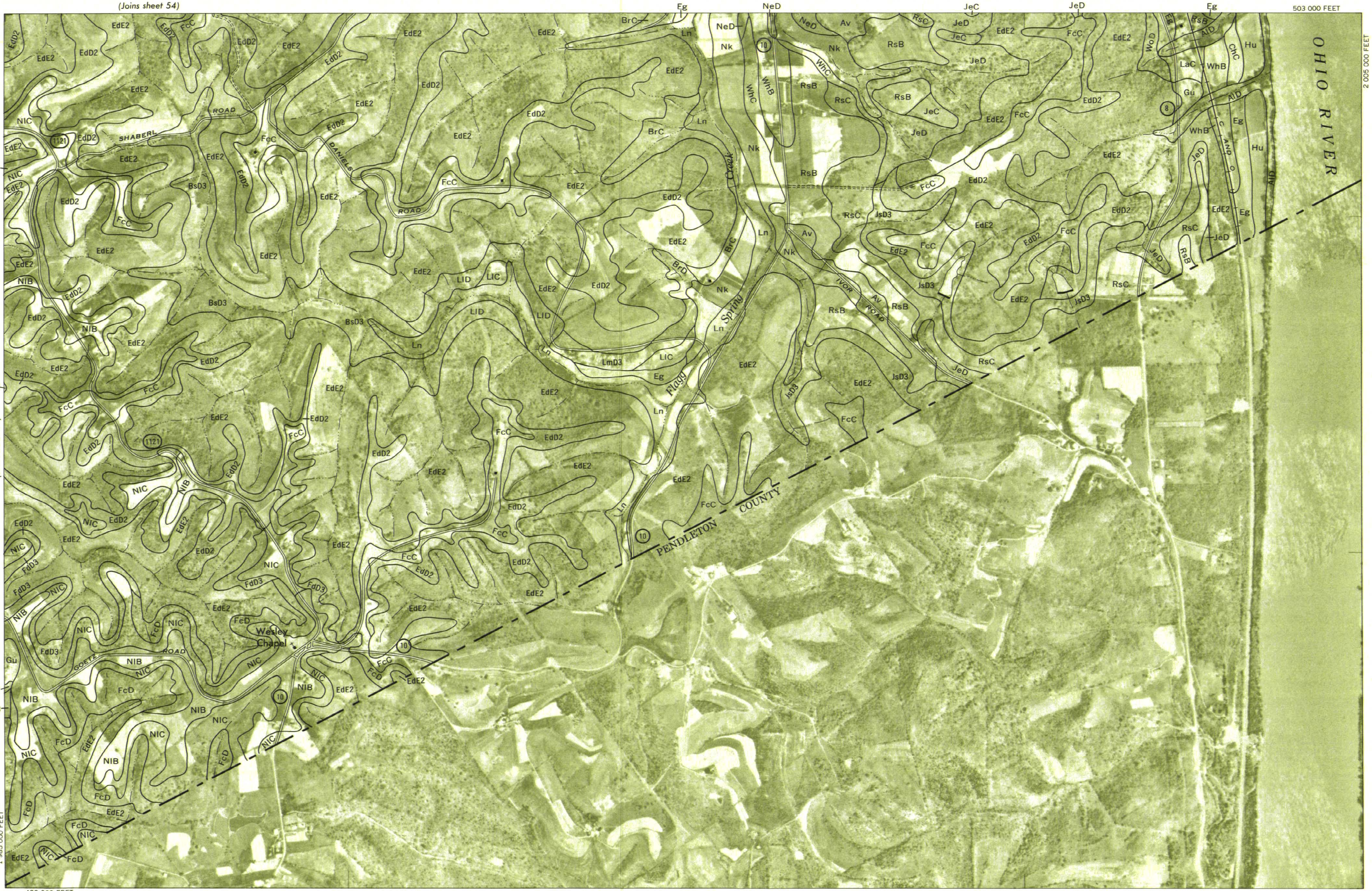
FISHER RD

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 62

N

(Joins sheet 54)

(Joins sheet 61)



503 000 FEET

2 005 000 FEET

1 985 000 FEET

490 000 FEET

1 Mile — ¾ — ½ — ¼ — 0 — 1

5 000 Feet — 4 000 — 3 000 — 2 000 — 1 000 — 0 — 5 000

Scale 1:15 840

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 63

63

490 000 FEET

1 845 000 FEET

(Joins sheet 55)

N

Huma

Big South Fork

Gallatin County

Little South Fork

(Joins sheet 64)

1 Mile

5 000 Feet

Scale 1:15 840

1 865 000 FEET

477 000 FEET

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 63

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

N

1 Mile

5 000 Feet

Scale 1:15 840

1 0 ¼ 0 ½ 1 000 ¾ 2 000 1 3 000 1¼ 4 000 1½ 5 000

(Joins sheet 63)

1 865 000 FEET

477 000 FEET

(Joins sheet 56)

490 000 FEET

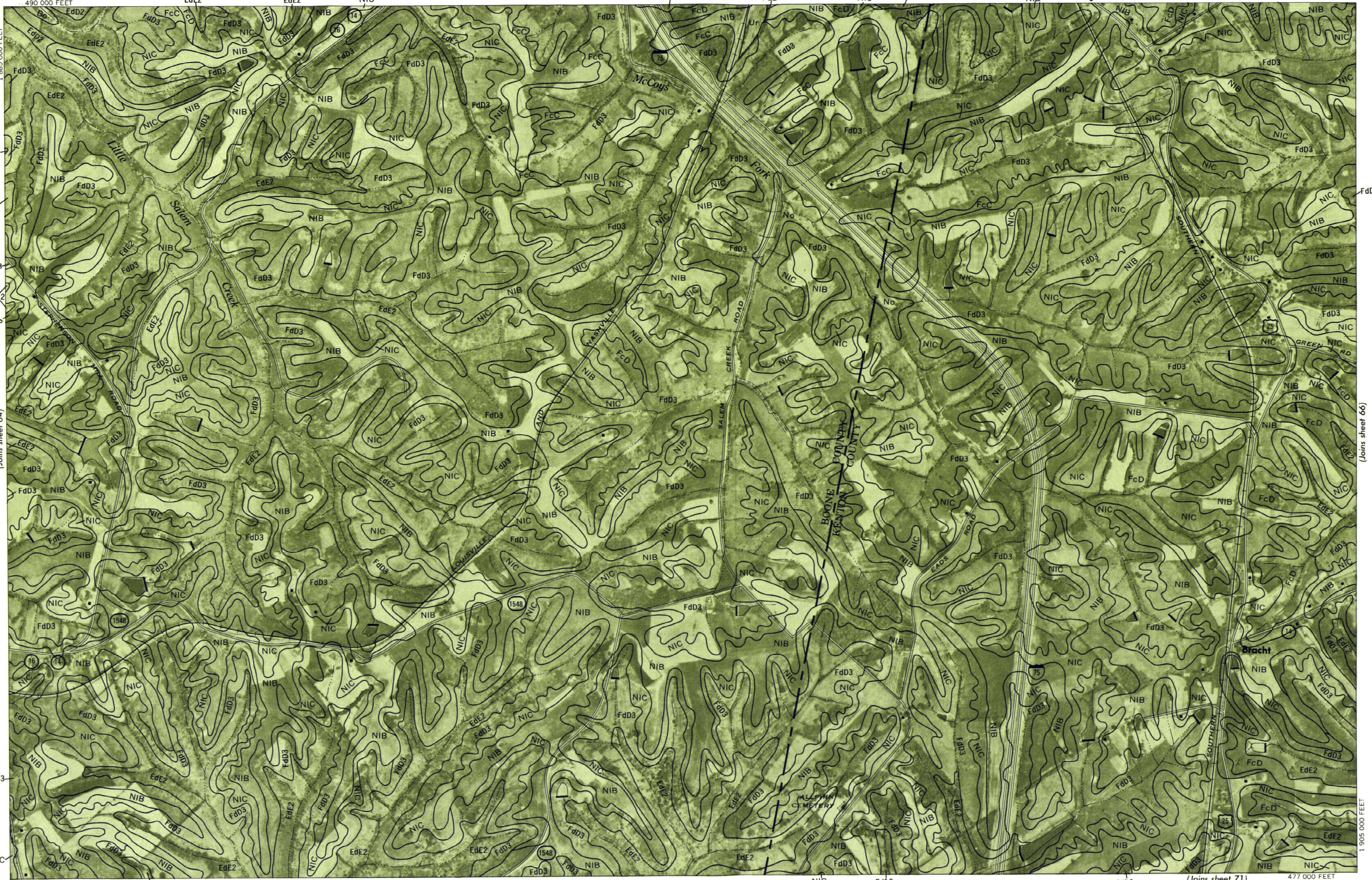
1 885 000 FEET

(Joins sheet 65)

(Joins sheet 70)

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



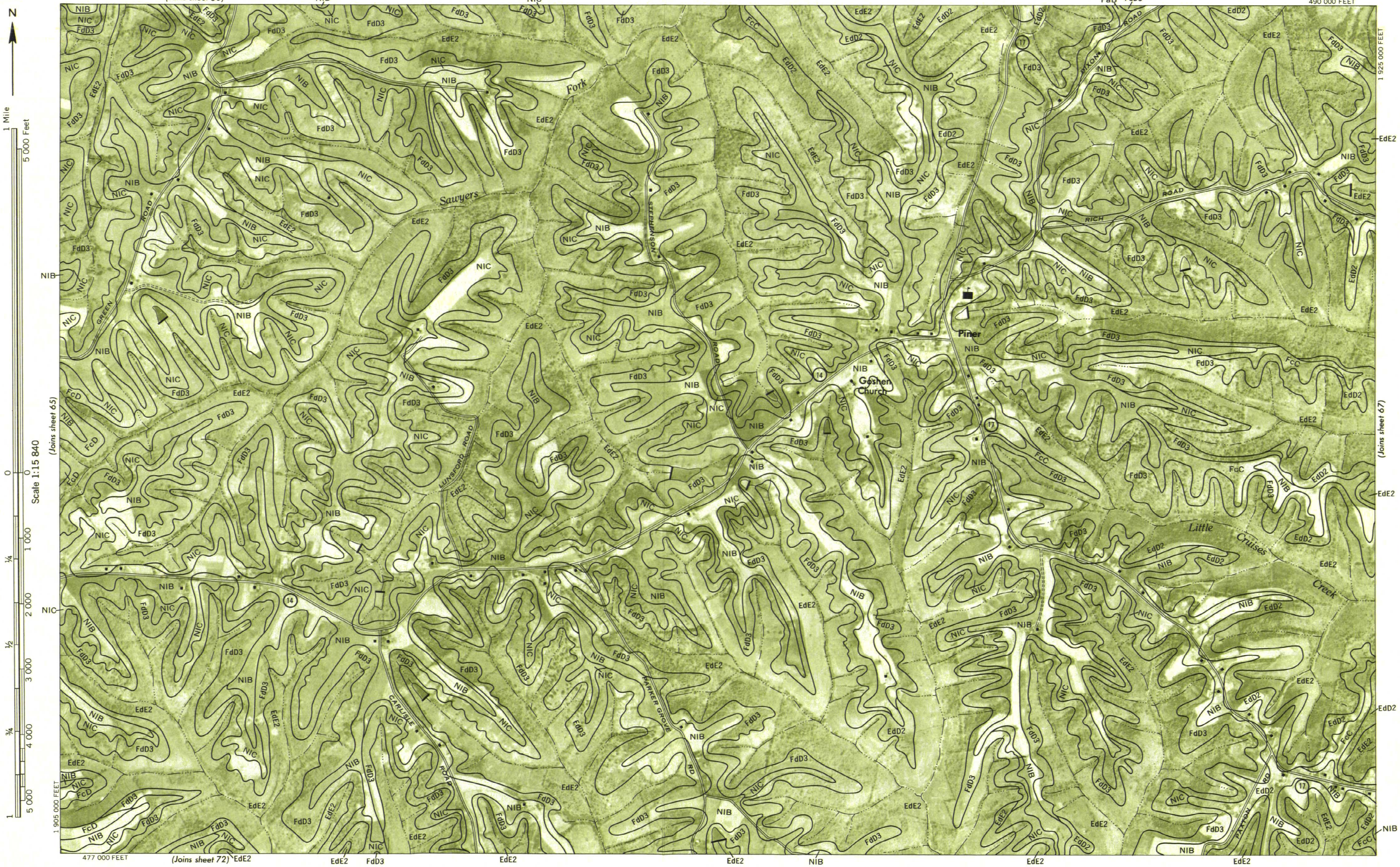
N

1 Mile
5 000 Feet
Scale 1:15 840

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 65

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 66



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 67

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

490 000 FEET

1 925 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

Morning View

Fiskburg

St Marys Church

Phillips

Cruises Creek

Little Cruises Creek

RICH ROAD

HEMPLING ROAD

FISKBURG MORNING VIEW ROAD

BEANSTEHEL RD

LOUISVILLE AND NASHVILLE

LICKING RIVER

BOONE COUNTY

CAMPBELL COUNTY

KENTON COUNTY

(Joins sheet 66)

(Joins sheet 59)

(Joins sheet 68)

(Joins sheet 73)

1 945 000 FEET

477 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15 840

(Joins sheet 67)

FcC (Joins sheet 60)

490 000 FEET

1 965 000 FEET

(Joins sheet 69)

1 945 000 FEET

477 000 FEET

(Joins inset, sheet 73)

PLEASANT RIDGE ROAD

MORNING VIEW ROAD

CLAY RIDGE ROAD

HISSEM AVENUE

NAGEL ROAD

HORNBECK ROAD

AUTUCK ROAD

MOSSVILLE ROAD

CAMPBELL — KENTON COUNTY

PENDLETON COUNTY

LOUISVILLE AND NASHVILLE

Phillips Creek

Plum Creek

Sandy Branch

LICKING RIVER

Alexander

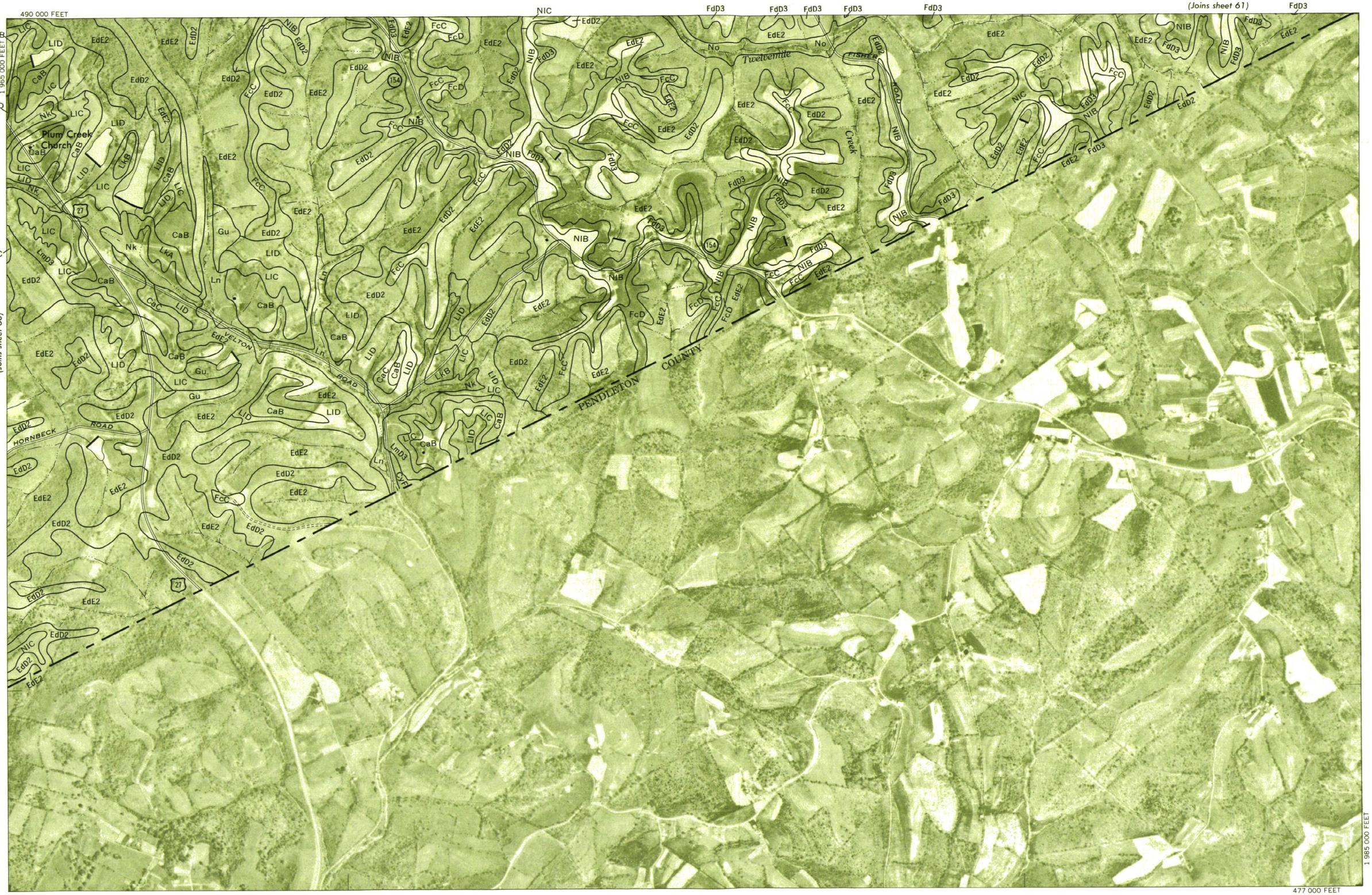
27

177

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 68



N

1 Mile
5 000 Feet

Scale 1:15 840

1 0 ¾ 4 000 ½ 3 000 ¼ 2 000 0 1 000 0

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 69

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — SHEET NUMBER 70

(70)

N

1 Mile

5 000 Feet

Scale 1:15 840

1 865 000 FEET

464 000 FEET

(Joins sheet 64)

477 000 FEET

1 885 000 FEET

(Joins sheet 71)

GALLATIN COUNTY

GRANT COUNTY

Porter Branch

McPherson

Louisville and Nashville

North Fork Ten Mile Creek

No Creek

Bullock Pen Lake

Bullock Pen Creek

EdE2 FdD3 NIB NIC FaB Eg EdD2 Gu

Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone, 1927 North American datum.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY — NO. 70

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 71

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

477 000 FEET

1 885 000 FEET

(Joins sheet 70)

(Joins sheet 65)

(Joins sheet 72)

Bullock Pen Lake

Bullock Pen Creek

BOONE CO

KENTON CO

GRANT COUNTY

SOUTHERN RAILROAD

1 905 000 FEET

464 000 FEET

N

1 Mile

5 000 Feet

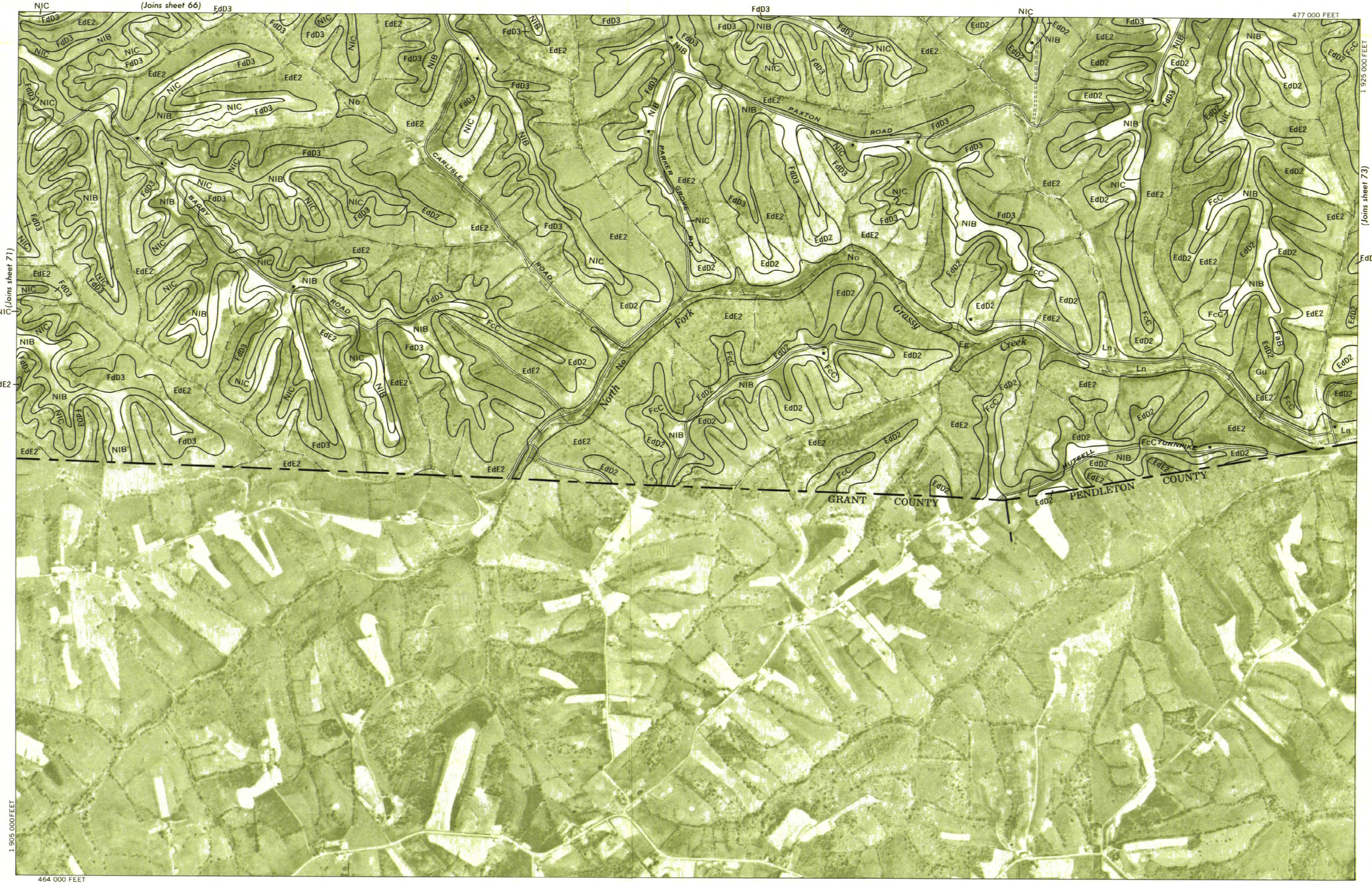
Scale 1:15 840

N

1 Mile

5 000 Feet

Scale 1:15 840



Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.

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BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY—NO. 72

BOONE, CAMPBELL, AND KENTON COUNTIES, KENTUCKY NO. 73

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1967 aerial photographs. Grid values based on Kentucky plane coordinate system, north zone. 1927 North American datum.